UNITED STATES ARMY

OCTOBER 1965

AVIATION DIGEST

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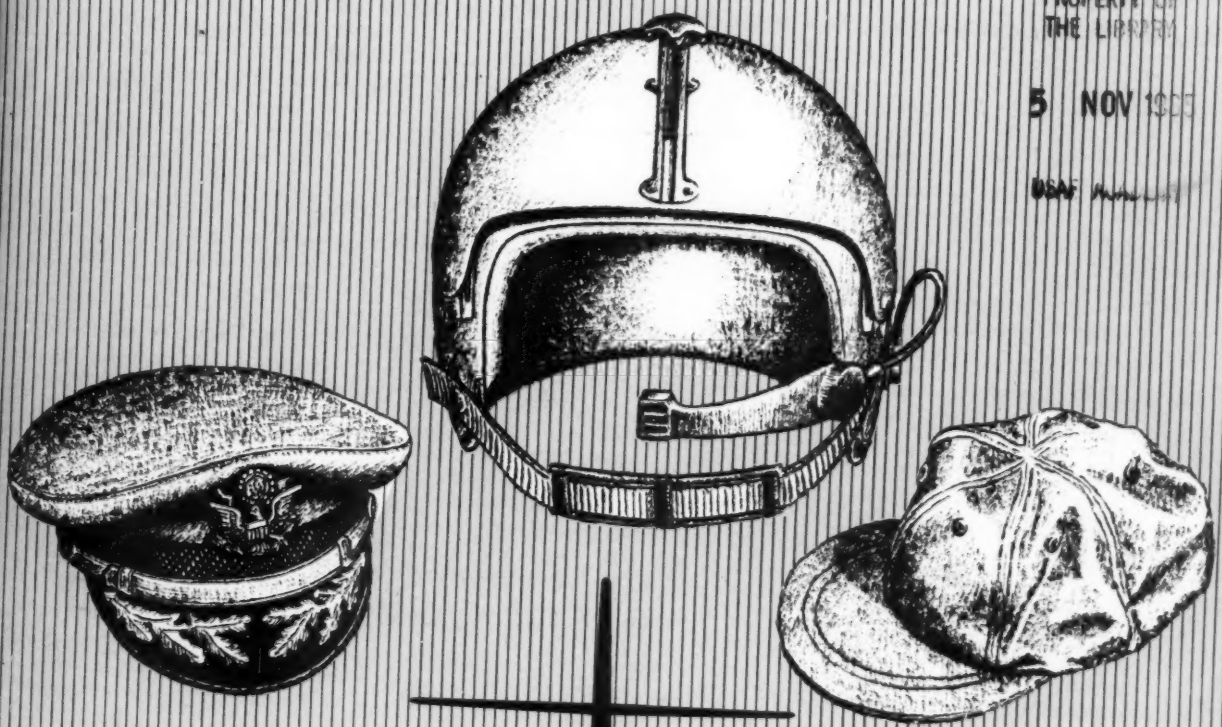

PROFESSIONALISM

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UNITED STATES ARMY AVIATION DIGEST

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U.S. Army Aviation Digest, Fort Rucker, Alabama.*

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LETTERS

Sir:

Reference the article by Barney Roth entitled "Tilt" (DIGEST, July 65) which we read with interest and found to be quite informative, since we encounter many grade A slopes here in Vietnam which would cause most flight instructors' hair to stand on end.

We would like to cast disparaging remarks upon the pilot he used to demonstrate with however (pictures 2 & 3). Like man, that cat ain't got no APH-5 on. We medical evacuation pilots love to see pilots who fly without helmets because when they crash, their heads bounce around like a cue ball and they normally suffer beautiful lacerations, bruises, fractures, and concussions. Who could ask for more because the medical aidmen that we carry on board our aircraft no longer have to read about these type injuries and practice with moulage sets because they have a real live??? pilot to work on.

Just kidding, but we are trying to make a point. We suggest that someone contact that pilot on UHF, VHF, SSB, FM or by use of simple arm and hand signals. Inform him to set that aircraft down at the nearest level spot and shut it down. Then go over and politely tell him to dismount and GO GET HIS DAMN APH-5.

PILOTS OF "DUSTOFF"
57th Med Det (Hel Amb)
Saigon, South Vietnam

Sir:

We are fast breeding a corps of officers who use experiences from Vietnam as a basis for doctrine, tactics, and techniques. It is therefore frequently necessary to look at the difference between how something works in Vietnam and how it *should* work. I refer to that portion of Captain Lenderman's article on "Airmobile Tactics and Techniques" (Jan 65) that deals with fire support. He states that "only coordinated close air support combined with airmobile operations is of value."

Coordinated close air support *is* of great value, but it is only a portion of the immense value of close coordination and use of all fire support means available to the force commander. Fire support coordination for an airmobile operation is a trying task that will tax the imagination and talents of any fire support coordinator. But a good fire support coordinator, with the approval of the force commander, will evolve the best plan of fire support for an airmobile operation, coordinating artillery fires within range of the objective area, airlifted artillery that supports the operation (these first two will *normally* be the primary means of fire support with other means augmenting these fires), armed helicopters, naval gunfire, and close air support.

The technique of coordinating all of these fires is a story within itself. Let's not overlook the fact that it should be done. There will be times when only one fire support means is used or available (such as close air support), but this should be the exception rather than the rule.

MAJOR EDISON V. HOEY
Fort Sill, Okla.

Sir:

Reference the July 1965 issue of the DIGEST, article "Tilt," page 42, column 2, lines 8-9 and 16.

It appears to me the thrust vector should be *perpendicular* to the horizon, not parallel, if the helicopter is to rise vertically from the slope. Is this in error or is my limited understanding of aerodynamics incorrect?

Enjoyed the edition very much, as all other editions. "Frozzleforth" is a welcome addition; his humor is so truthful it sometimes hurts. The Award Winner by Major Clapp was well written, interesting and most deserving of recognition. Army Aviation needs more assets with that type thinking machine.

Keep up the good work.

MAJOR HAROLD O. BOURNE
13th Sig Bn,
1st Cav Div (AM)
Ft Benning, Ga. 31905

Oops! Sorry about that. You are absolutely correct. The word should have been "perpendicular."

Professionalism

Lieutenant Colonel John G. Cleveland

WITH SO MANY aviation battalions in or on their way to combat in Vietnam, you may think that this article should place more emphasis on preparing for combat, less on day-to-day garrison work. Operations won't even be mentioned. If your people are motivated to do their jobs, if they habitually keep their equipment in a high state of operational readiness, and if they fly well, fly precisely, fly safely, then your battalion will certainly operate effectively in combat.

First, before taking over your command, become familiar with the table of organization and equipment and with the scenario of your unit's annual training test. The former sets up your organization and states your unit mission, while the latter describes typical unit operations. Also look over checklists used in preparing for annual inspector general and command maintenance management inspections. These guidelines, together with Army custom and doctrine, will provide you with a solid foundation upon which to base your many daily decisions. Study these guidelines and accept them as facts of life.

Second, using these guidelines, extract the really important objectives you wish to achieve. State these goals and use them to give your battalion direction, inspiration, and incentive.

Next identify the problems which stand in the way of reaching your goals. Get help from your key people, not only in establishing your goals and identifying

Col Cleveland is with the Airmobility Division, Office Chief of Research and Development, Washington, D. C.

Motivated people, quality maintenance, a low accident rate, and effective training—these goals deserve most of a battalion commander's attention

your problems but also in finding solutions to your problems. In an aviation battalion, the goals which will deserve most of your attention are motivated people, quality maintenance, a low accident rate, and effective training.

PEOPLE

People, your most precious commodity, need to be led and inspired. You lead them by defining your battalion's goals, identifying the problems which stand in the way, and seeking solutions to the problems. You inspire them in the way which best suits your own personality. Here are a few helpful hints.

• Set up your chain of command and *use* it. Make sure it's solid all the way down to the mechanic's helper. Be sure the chain of command is the loudest and clearest of all the communications channels that exist in your outfit. Be particularly sure that it's open from bottom up, and that it is used this way almost as much as it is from top down. If subordinates aren't talking to their superiors frequently and easily, then break open the channel by asking questions rather than giving directions.

• Work constantly with your commanders and key staff officers. Seek their advice. Point out their problems when they do not appear to see them. Give them guidance where necessary, but try to have them set their own goals, identify their own problems, and establish their own tasks within the framework you have provided.

• Ask "soldier information." Start by asking your company commanders. Have them ask their platoon leaders. The platoon leaders ask the section sergeants—and right on down to the bottom man. Soldier information includes chain of command, general orders, code of conduct, unit mission, assigned duties, maintenance information, individual weapon information, and any special subjects such as CBR or emergency medical care which you might be pushing at the time. Also ask the individual what his major problems are and how he thinks they should be solved.

This technique of asking questions serves several purposes. It lets the individual know he's important. It ensures that everybody knows his soldier information, thus demonstrating his professional knowledge and improving his soldierly qualities. It opens the channel for that all important feedback from the bottom of the line. And it forces you to establish or identify a chain of command in those cases where the TOE doesn't do it for you.

• Give credit where credit is due. Anything that's done well in your unit reflects favorably on the whole outfit. Give people credit for doing things well, and you'll find them looking for more areas in which to excel. It's a snowballing process.

• Require spit and polish. A neat crisp personal appearance, neat and business-like offices, and clean equipment not only make the individual proud of himself and his unit, but they also make that all-important good first impression on anyone who comes to look at your operation. This first impression will be the most important factor in establishing your unit's reputation.

• Resist unnecessarily transferring people around. Already so much personnel turmoil is forced on you to meet so-called unprogrammed requirements that you can't fail to improve efficiency by keeping people in their jobs long enough not only to learn them but also to perform them efficiently.

QUALITY MAINTENANCE

An aviation battalion performs its mission by operating machines. Since it can fly only if aircraft and equipment are properly maintained, you must put a large part of your effort into the maintenance business. Attack the maintenance problem on each of the major fronts which contribute to good maintenance.

Trained operators and mechanics. See how many of your operators and mechanics are technically qualified for the slots they occupy. If they are not qualified, have the S-3 send them to school or assure that they are given on-the-job training under qualified specialists to gain the skills they need. If your battalion is short maintenance personnel, have your S-1 procure them for you.

Publications. In a business as technically complicated and sophisticated as aviation, you must insist on maintenance by the book. Department of the Army has put a tremendous amount of effort and research into establishing effective maintenance procedures for all your equipment. There is an operator's and organizational maintenance manual for every

piece of equipment and every tool set in your battalion. These manuals must be in the hands of the people who need them.

Be sure that your operators, crewchiefs, and mechanics have these manuals and follow the written procedures. Perhaps even more important, be sure that your company commanders, platoon leaders, and section sergeants have and read their own personal copies of the more important DA publications on maintenance. These include DA Pamphlet 750-1 "Preventive Maintenance Indicators for Commanders," DA Pamphlet 750-2 "Post Level Preventive Maintenance Course," DA Pamphlet 750-38 "The Army Equipment Record System," and *PS Magazine*.

If any of these publications are missing or in short supply, have the S-1 obtain them through the new pinpoint distribution system.

Tools. Each operator, crewchief, and mechanic should have a complete set of tools as authorized in the TOE. Make spot checks to see that they have all their tools, keep them clean and in good condition, and use them properly. When you find deficiences, take corrective action.

Spare parts. For good maintenance you have to have the spare parts you need, on hand, in the right quantity, at the time you need them. This is possible only if your spare parts clerks run their prescribed load lists (PLL) the way higher headquarters says they should be run. Check your PLL to see that proper procedures are being followed and that the supply cards accurately reflect what is in hand and on order.

Supervision. Personal interest on the part of the commander is probably the greatest catalyst in a unit. Take the company commander with you and systematically spot check each type of equipment in each company, platoon, and section. **The many preventive maintenance checklists available will make it easy for you to make these spot checks.**

Another useful technique is to require periodic reports on the status of all equipment which is not fully operational: daily reports on the aircraft; weekly reports on vehicles and radios; monthly reports on items such as weapons, gas masks, and typewriters which don't take so much maintenance effort. By keeping track of what equipment is down, why it is down, and what's being done about it, you will find the lists getting shorter each week.

Your active and personal interest in the condition of your unit's equipment is almost guaranteed to bring about immediate and noticeable improvement.

LOW ACCIDENT RATE

The time you spend on an active accident prevention program will pay dividends you didn't believe possible. Your program should stress healthy attitudes, healthy bodies, and accident prevention surveys.

Healthy attitudes. The basic philosophy of an accident prevention program is that in the final analysis accidents are caused by human failure somewhere along the line. Potential failures can be detected and corrected before they happen if each individual in your battalion is accident prevention conscious and anxious to correct hazardous situations.

Probably the greatest catalyst in a unit is the commander's personal interest

You can instill this attitude in several ways. The simplest approach is to put out the directive "Do not have accidents." This, like hitting the mule over the head with a baseball bat to get his attention, is bound to impress people with the importance of safety.

A more reasoned approach is to establish a high standard of excellence in all aspects of maintenance and flying. **Cultivate in your pilots a healthy and positive attitude toward flying.** Have each pilot think of his flight in its various phases: briefing, flight plan (route, altitude, radio aides, checkpoints, landing areas), weather check, walk-around, cockpit check, preflight check of all radios and systems, inflight procedures, parking, shutdown and tiedown procedures, flight plan closure, and final critique.

He should perform each phase so thoroughly and meticulously that he is subconsciously sure that he understands all aspects of the flight, will handle each aspect competently, and will use the correct procedures in case of emergency. Standardization, attention to detail, planning, and execution according to checklists are marks of excellence.

A third approach is to keep the subject constantly before your aviators and mechanics. Use safety posters and bulletin boards with fresh and interesting displays. Distribute material such as Flight Safety Foundation bulletins and USABAAR's *Weekly Summary* of aircraft accidents and incidents. Each morning at the daily operational and weather briefing, have

someone present a cogent word on safety. And make sure your monthly safety meetings are occasions to which all your aviators look forward.

Remember that anxiety, slipshod or careless procedures, half-baked plans, lack of knowledge or disregard of regulations, and action based on emotion rather than judgment are all evidence of improper attitudes which your safety program can correct.

Healthy bodies. Physical fitness sharpens mental acumen and gives the high muscle tone which is good insurance against fatigue and weariness brought on by long, hard flying. If a tight schedule of operations and maintenance activities keeps you from having a first-rate athletic program during duty hours, then encourage your people to undertake individual fitness programs on their own time.

The beauty of these programs is that each person, depending on his own interests and abilities and using whatever time and facilities are available, can choose his own sport and his own set of daily calisthenics. Swimming, golf, tennis, bowling, and hunting are all good individual sports, while either the Canadian Air Force 5 BX program or the Army's Physical Fitness Program for Staff and Specialist Personnel (DA Pamphlet 21-1) is good for daily periods of strenuous exercise at home.

Let your people know that a healthy body needs not only exercise, but also good sleep, a good breakfast, and a balanced diet.

Accident Prevention Surveys. Each year USABAAR puts out an excellent pamphlet on accident prevention surveys. You will see that this pamphlet is actually a checklist which goes to the very core of your troop leading and management procedures. It cuts pretty well across the entire gamut of your responsibilities. Have your safety officer and other primary staff officers conduct periodic surveys, using the sections of the pamphlet which cover their responsibilities. Check to see that deficiencies found during the surveys are corrected. If a checklist shows that your battalion has no deficiencies, its aircraft accident record is doubtlessly clear, and you can be sure you have a first class outfit.

In unit training start with the easy and simple and progress to the more difficult and complicated

EFFECTIVE TRAINING

You may feel that training should be included as part of your safety program, for no unit can fly safely if it is not well trained. Training, however, is so important that it deserves a separate section as one of the four major areas of concern to you.

Have a training program which stresses fundamentals. The basic phases of the program might be: initial orientation and checkout, continuous standardization, night flying, instrument work, and tactical work. While these phases will often be conducted concurrently, they should start with the easy and simple and progress to the more difficult and complicated.

Have all new aviators who report into your battalion thoroughly briefed on the local flight rules, regulations, and conditions. Show them how the companies brief aviators on their missions. Have them become familiar with all flight planning, weather, and navigational and voice radio facilities on the airfield. Then have an IP give them a good solid checkout in the local area in the type aircraft they will be flying.

This flight should be the first of a number of periodic standardization rides designed to keep pilots sharp and thorough. Use fully-trained and standardized instructor pilots who stress the fundamental procedures and techniques taught at the U. S. Army Aviation School.

In your night flying training, start off with simple maneuvers, using full lights, on big easy strips. Progress to minimum lighted work from small confined areas. Try allocating one night a week, from 1600 hours to 0200 hours, for training, with compensatory time off the next day.

Your instrument program should stress as much actual instrument flight as your aircraft, the local weather conditions, and instrument flight facilities permit. Again, use your best qualified aviators, preferably instrument examiners, as IPs.

In your tactical work, stress fundamentals and precision, progressing from conditions which leave wide margins for error to conditions which require maximum performance from both aircraft and aviator. This work should include operations out of confined areas, formation flying, low-level navigation, and special tactical missions which your unit is capable of performing, such as gunnery or photography.

One final thought. Keep your boss informed of your problems and what you're doing about them. Let him know your goals and be sure you understand his. He, too, will no doubt want motivated professional soldiers, high quality maintenance, accident free and precise tactical flying, and a responsive, well trained, spit-and-polish organization.

additional duty for the mohawk

Captain Bobby H. Freeman

MOHAWKS HAVE a new type of mission in Korea. In addition to normal surveillance missions, the OV-1s are used as a flying fuel station. The logistical problem of supplying JP-4 fuel in Korea has left a void at many isolated airfields and heliports. In direct support of Eighth Army Headquarters and United Nations Command, the 55th Aviation Company requires UH-1 helicopter missions over extended ranges away from JP-4 refueling points. Before the arrival of the Mohawk, JP-4 had to be transported by vehicle and stored in 55-gallon fuel drums in advance of any planned UH-1 flights into these remote areas.

Today when a Huey mission is scheduled for a remote site, a Mohawk refueling mission is concurrently scheduled with the Aerial Surveillance and Target Acquisition Platoon of the 55th Aviation Company.

A refueling stop is less than 30 minutes duration and requires no special equipment. A standard OV-1 defueling hose with a refuel-

Capt Freeman is with the Aerial Surveillance Platoon (Provisional), 55th Aviation Company (Army), APO San Francisco 96301.

ing nozzle attached is used to transfer fuel from the Mohawk to the Huey. A leak-proof canvas bag is used to contain the hose and is transported in the baggage compartment. The only other item needed to accomplish the refueling mission is a grounding cable.

Actual refueling is accomplished as follows:

With the number 2 (right) engine shut down the OV-1 taxis next to the UH-1 with the right sides of the aircraft being adjacent or parallel to each other. Then the number 1 (left) engine is shut down. The hose is connected to the defueling point on the OV-1 and, with the ground connected, the master defuel switch and the drop tanks defuel left and right switch are engaged. Fueling is accomplished in a conventional manner. Airlocks are bled off by opening the valve on the central point defueling hose connector.

After fuel flow has been established the drop tanks defuel switch is disengaged and fuel flow continues by gravity feeding. Another OV-1 can be refueled in the same manner as a UH-1, except that the drop tanks defuel switch or the cockpit drop tanks pump switch must be left on to pressurize the main fuel cell for over the wing type refueling. This operation requires an external power supply.

When the aircraft is fueled, the master defuel switch is disengaged and the hose disconnected. The hose is then drained of all fuel and placed in the Mohawk baggage compartment, secured inside the carrying bag.

Points to remember in this operation are few but vital to the accomplishment of the mission. The Mohawk must be level with or higher than the UH-1. Also, the drop tanks defuel switch must be turned off after gravity feeding is established so the aircraft battery is not too weakened to provide a start.

The Mohawk's primary mission of securing vital combat information at medium ranges for Army commanders has not changed. However, with this additional capability, operating ranges of the UH-1 and OV-1 aircraft have been greatly extended. In this new role the Mohawk has once again proved itself valuable to the U. S. Army.

Standard Mohawk defueling hose and nozzle do the trick

Refueling Huey from Mohawk requires less than 30 minutes. It's important that OV-1 be level with or higher than UH-1.

Vietnam Dragonfly

PFC Richard Busse

WHILE MOST soldiers newly arrived in South Vietnam are still asleep in a tent-city reception station, a pilot in a kind of gas-turbine dragonfly on an Army Aviation company flight line not far away presses a starter button.

A hissing, whining sound erupts from the metal insect's large dorsal exhaust. Its rotor blades begin to revolve, biting the air in a staccato of sharp slapping surges. The insect is awake.

In almost the same instant the story is repeated a dozen times or more on either side along a dim perimeter. These aircraft are Hueys, famed armed helicopters with a lethal sting.

The faint morning light does not reveal the details of each ship's armament, but it is enough to know that their machineguns and rockets will be used this morning. From the air they will attack the Viet Cong guerrilla, slow his offensive surprise tactics to a defensive stand-up fight in the open. They will pick up and deliver South Vietnamese troops in hostile areas and provide armed cover for their operations. The Hueys' missions are routine.

Gunners sit in open side doors behind their outward pointing weapons, silhouetted against dark interiors. Pilots and copilots are vaguely discernible behind their ships' plexiglass faces.

Other shadowy dragonfly-like forms tipped with red and green blinking lights begin to ascend vertically, as their hissing grumble becomes a sustained crescendo. More follow until the blinking lights overlap in a cautious procession high above, which heads out across country as skillful hands guide controls.

Men awaken in the tent city. Some watch the rising lights assume more distinct form in the brightening sky, impressed by the power being displayed.

Minutes pass. The noise fades. The sun rises upon an empty strip of concrete and asphalt, blemished by patches of grease and oil where the swift Hueys lifted off a little while before. The sound of powerful engines is gone now. A weathered windsock flutters from atop a faded yellow hangar. Within the building a company of mechanics and maintenance men repair and modify other Hueys. Farther down the flight line a few drab-green dragonflies which did not make the morning mission sit poised and rigid, as if feeding upon something with great concentration.

The sky clouds up for another frequent rainstorm, typical of the Southeast Asian monsoon season. Rain pelts the yellow hangar, the asphalt and concrete, and goes, but the sky has not emptied itself.

On the flight line the day becomes hot and sweltering as usual, teased occasionally by a breeze which comes and goes, and a bashful sun which makes brief appearances of scorching thoroughness. Wherever the Hueys are now or have been, the weather can be no better. Hours pass.

Over another part of the country a flight of drab-green dragonflies form a loose wedge as they head back toward that familiar rectangle of concrete and asphalt somewhere ahead beneath a sodden mass of rain clouds. Oddly enough the air up there can chill a man. Side doors are shut.

Each Huey burrows an invisible tunnel through the heavy air, blades churning their way around formidable cumulus and other areas of ominous blackness. Each is lighter now because much of their ammunition and most of their fuel is gone.

From a distance all machines look normal, intact, unscathed, but from a distance one cannot see the small holes and dented metal. In those ships men bleed where enemy groundfire has reached them. They and their machines have been to war, and the war has not been beneficent.

A faint growling filters through late morning's damp grey skies and settles over the puddled flight line. It grows more distinct. Ground crewmen wait, knowing a lot of maintenance work is coming home on whirling blades. Tent city looks up again.

The swift little Hueys return in two's and three's, swinging around the flight line on their approaches. The air thunders and splits apart as each chopper rushes in over its assigned space below, smashing a tornado of air downward with enough force to send tin sheeting flying like cardboard.

Puddles are rippled, stretched, and dispersed under their blasts. Each helicopter slows to a hover before beginning its gentle descent. Their steel runners touch the parking apron and settle beneath the tonnage resting upon them.

Every ship has come home, settled, and quieted as their rotor blades free-wheel down to a slow silent rotation long after their crews have helped to evacuate the wounded and departed.

There will be another mission tomorrow morning for Army aircrews, if not another one today. Many more will be needed after that, because the day of this kind of warfare is still a full circle of the sun from being finished in Vietnam.

Shake Hands With Your Rescuer

Captain William R. Kaler

I AM OUT OF the aircraft! I've checked myself for injuries. Now what? How did those survival phases go? Let's see . . . lifesaving, signaling, shelter and food —or is it lifesaving, shelter and food, and signaling. Signaling! That's it. As I recall, they said to be ready to signal at all times. Better check the aircraft radios. I could use the parachutes. From the looks of this area I may end up walking out.

The importance of signaling cannot be overemphasized; nor can the possibility of having to *walk* out of an emergency situation. These two survival elements

Shake Hands With Your Rescuer

normally receive less attention than fire-building, shelter-building, food, water, etc. I consider signaling the key to survival. Proficiency in the use of standard signals and signaling equipment may greatly reduce the time until rescue. More important is the ability to improvise in the absence of equipment.

Our present signaling equipment is simple in construction and operation. Very little training is required for its use. However, it is recommended that you familiarize yourself with this equipment before an actual survival situation. *On the job training* during an actual situation could result in failure to be rescued.

The radio is by far the best means of giving notice of an impending emergency. As soon as the emergency is recognized, the first thing that should come to mind, other than normal emergency procedures, is to use the aircraft radio. Even in nap-of-the-earth flying, time usually permits emergency procedures and a few hurried transmissions on your assigned frequency.

You can see the danger in trying to make a frequency change to the guard channel and attempt a forced landing at the same time. You may not accomplish either one. At altitudes above 1,500 feet absolute a frequency change is then advisable. Once on the ground the use of radios will depend upon the damage sustained to the aircraft or the availability of one of the small survival radios.

Presently we have the AN/URC-4 (see fig. 1), AN/URC-11, and AN/URC-14; in the future we will have the AN/URC-10. All are issued on the basis of one per aircraft within an aviation unit.

The AN/URC-4 has the capability of transmitting and receiving both UHF (ultra high frequency) and VHF (very high frequency) with the radio normally preset to the guard frequencies. The frequency range is from 120.0 to 130.0 mc VHF and 240.0 to 260.0 mc UHF. In addition to voice, a *homing* capability is also incorporated into this radio. Special ADF equipment (normally found in aircraft assigned to search and rescue units) is required to net with this set. The transmission and reception range depends almost entirely upon the terrain, with an average range of 10 to 12 miles.

The AN/URC-11 and AN/URC-14 are single channel UHF and VHF radios respectively. Both are preset to their respective guard channels and cannot be changed to any other frequency. They have the same transmission and reception ranges as the AN/URC-4.

Past survival experience reports have indicated that these radios become inoperative with very little rough treatment. This has been one reason for the production of the AN/URC-10. This is a lightweight transistorized radio, UHF only. It does have the capabilities of transmitting and receiving more than one frequency and *homing*. The use of transistors has made this radio much more durable than the older models. Other improvements found with the URC-10 are a much improved battery life, from 24 to approximately 100 hours; weight is 3 pounds, exactly half of the AN/URC-4; and the average transmission and reception range is approximately 30 miles.

Use of the radio depends on various factors: whether assistance is within reception range, battery power available, type terrain. If assistance is within range, transmit distress calls as necessary. Otherwise, to conserve battery power for maximum usage, transmit at 30-minute intervals or on a schedule arranged before takeoff.

Another possible answer is an automatic tumbling airfoil radio

---

Capt Kaler is now attending the Armor Officers' Career Course, Ft Knox, Ky.

THE NEED

During the period 1 January 1962 through 21 December 1962 searches were initiated by Air Rescue Service for 254 aircraft, both military and civilian. Participating in the search missions were the various military services and the Civil Air Patrol. (The CAP is a civilian organization utilizing member pilots and aircraft and also utilizing other private pilots and their aircraft to conduct search missions, at the request of the official SAR system.)

In an effort to locate the 254 downed aircraft, a total of 12,373 aircraft sorties were flown a total of 25,974 flying hours. Of this total search effort, over 60% were flown by CAP. The cost in gasoline alone for this CAP effort amounted to over $60,000.

There were a total of 801 persons on board the 254 lost aircraft. Of these 335 were found alive, 408 had perished, and 58 people were never located at all.

Of the CAP personnel involved in searching, six additional lives were lost on actual search missions or on practice searches.

FLIGHT SAFETY FOUNDATION INC

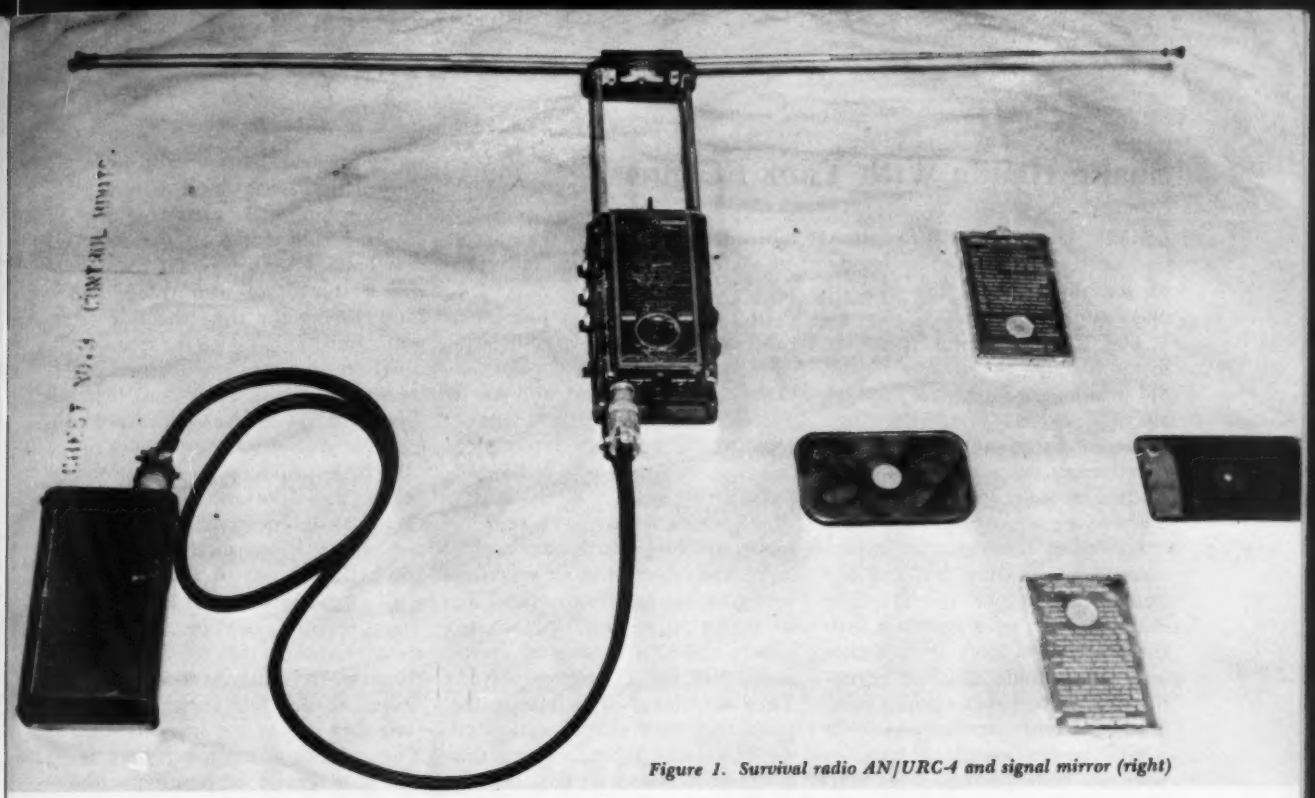


Figure 1. Survival radio AN/URC-4 and signal mirror (right)

beacon—the Mk 200 Crash Position Indicator (CPI) * manufactured by Leigh Instruments Limited, Ontario, Canada. It is mounted in a launcher or in the fuselage of the airplane. If the plane should crash or suffer severe stress, the indicator flies into the air, and starts broadcasting a distress signal.

It is shaped like an airfoil, weighs 6 pounds and measures 20 inches in diameter. Its design develops high lift and drag forces, causing it to curve up and away and slow to a safe landing speed of less than 26 miles per hour.

Inside the airfoil is a radio transmitter complete with nickel cadmium batteries. Immediately upon release, the transmitter begins to radiate an omni-directional distress signal with a range of approximately 40 miles.

The signal radiated is on a frequency of 243 mc, the standard emergency frequency, and can be either continuous wave or pulsed. If CW the output will last for better than 48 hours. The pulsed output is primarily for use in remote or arctic areas and provides search signals for a period of over four days.

Because of the planar antenna configuration an omni-directional signal is transmitted regardless of which side of the airfoil is upright. Should by accident the airfoil come to rest in a vertical position, an adequate pattern still will be transmitted.

The mechanism is completely wrapped in a shock absorbing foam. Along with the inherent design which allows the airfoil to drift to the earth slowly, this foam protects the transmitter from shock on a hard surface landing. It also permits the airfoil to remain on top of soft snow and other soft material and to float 85 percent out of water.

The airfoil with its transmitter is mounted on the aircraft in a launcher or in the fuselage as far aft and as high as possible. The launcher is an aluminum, permanently mounted spring unit which is either mechanically or electrically triggered. The trigger or crash detector is located as far forward on the fuselage as possible.

Experiments by the National Research Council of Canada have shown that there are more than 30 milliseconds from the time the nose of an airplane hits in a crash from the time the impact is felt by the aft portion of the airplane. The crash detector takes only a few milliseconds to trigger the launcher. Therefore, the indicator has time to clear the aircraft before it becomes involved in the accident.

It is thrown sufficiently far away from the accident scene so that it will not be subject to burning if a fire should start. At the same time it is not thrown so far away that it will lead the rescuers to the wrong position.

A small control unit is mounted in the aircraft cabin to permit

*See NCR Beacon, AVIATION DIGEST, June 1964.

Shake Hands With Your Rescuer

periodic tests of the transmitter and to provide manual operation of the unit should the aircraft make a forced landing.

The Crash Position Indicator seems to offer the answer to the old problem of locating a downed aircraft. Actual flight tests are being conducted to determine its effectiveness. It is presently being studied by the military services for possible use on various aircraft.

Following the radio in importance as a signaling device is the signal mirror (see fig. 1). The signal mirror, or a usable substitute, has led to more rescues than any other single item of equipment. The mirror is a component of individual survival kits. It would be an excellent item to have on your person. Operation of the mirror is very simple. Normally instructions are printed on the back. The main point to remember is that once contact is established, it must be maintained by continually flashing the mirror on the contacted object (aircraft, ship, etc.).

In the absence of a mirror, a shiny piece of metal would be a good substitute. Punch a hole in the center of the metal, and use it the same as a regular mirror. Long range contact is very important; this is provided by the radio and the mirror.

Sometimes failure to be rescued results because search and rescue units are never able to establish your position on the ground. This is where the flare, parachute, panels, and similar items of equipment (see fig. 2) are employed. They are designed primarily for indicating your exact location on the ground. When using this equipment, move to the nearest open area to gain maximum effectiveness. This definitely makes for easier identification from the air.

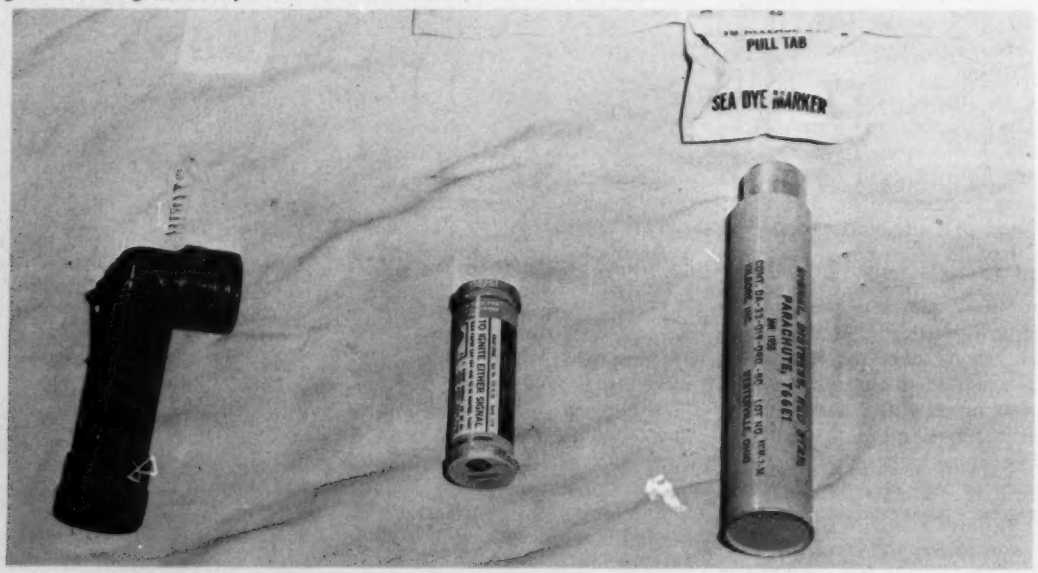
The dye marker (see fig. 2), though primarily designed for water survival, has several uses in conjunction with land survival. In snow areas, by scattering the coloring compound on the snow you have a usable signal. Along the seashore, you can color the sand during the time the tide is going out.

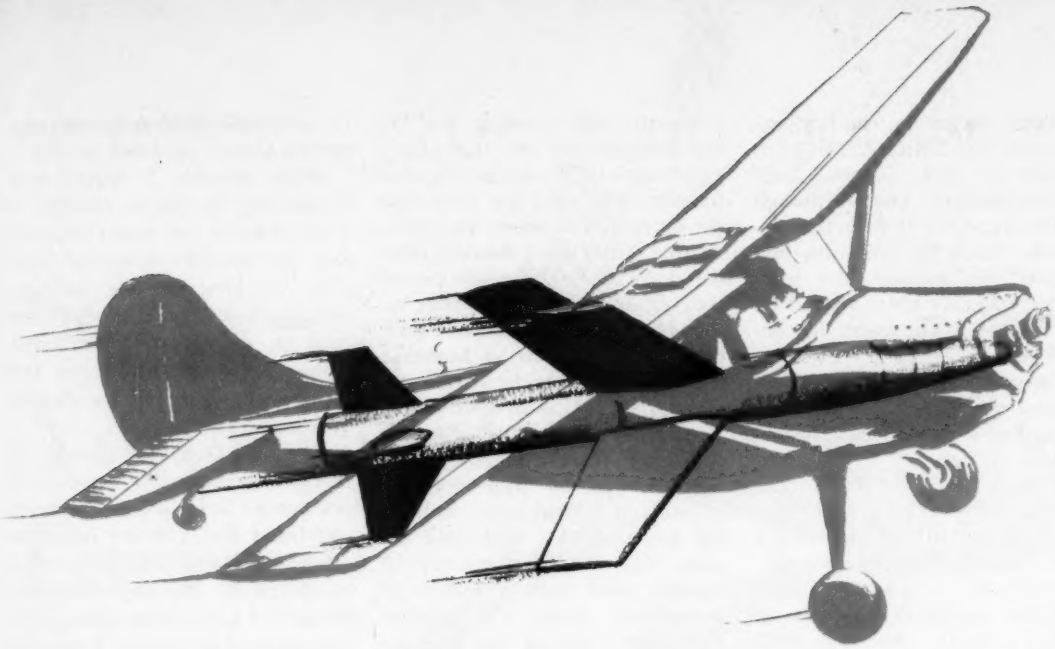
When there is an absence of equipment the survivor must then revert to his own ingenuity in constructing signals. Knowledge of how to improvise signals is probably more important than the use of signaling equipment. Remember, there is no guarantee that you will get out of the aircraft with anything but yourself.

Improvising can be anything from tramping out an S.O.S. in the snow to lining up rocks in the desert. It depends entirely upon your own ability and imagination. The point to remember here is that you should be familiar with the designs used as emergency signals.

When do you stop signaling? The answer: when you can shake hands with your rescuer.

Figure 2. Flashlight, flares, dye marker are survival aids for land or water use





Bird Dog Missile

Captain Frank M. Powell

USE THE O-1 as a substitute for a missile? Impossible! Not entirely—at least in a training situation. In fact, at Fort Sill in 1959, the trusty O-1 was used to simulate the trajectory of the Lacrosse missile in order to train missile guidance central personnel of the newly activated battalions. This unique story is being retold here because it shows what can be done when initiative, imagination, and teamwork is used in the employment of Army Aviation.

Early in the Lacrosse program it was planned to use tactical equipment for training personnel. It was apparent that guidance central personnel could be trained to make the proper settings and operate the equipment, but confidence could be achieved only through actual missile firings.

Due to the cost of the missiles, the funding for training ammunition reached astronomical proportions. Therefore, some method had to be established to reduce training costs. The Lacrosse missile trajectory simulator and other associated training devices were born through the efforts of personnel from the Artillery and Missile School and the Army Rocket and Guided Missile Agency (U. S. Army Missile Command).

To develop the trajectory simulator, an O-1E was modified by adding a 100 ampere generator, a circuit breaker safety device, and removing the rear seat. A special rack was constructed and installed on the rear seat supports. The rack provided a mount for the guidance components, transponder, radio beacon, motor generator, and a junction box to connect the equipment with the aircraft electrical system. Location is shown below.

The operation of the simulator was simple. The radio beacon provided a tracking signal for the ground guidance equipment. From this equipment guidance signals were transmitted to the airborne transponder. Here they were converted to useable form and applied to the course indicator on the pilot's panel.

Nothing was new about this indicator. It was the standard omni-ILS instrument. The pilot then flew the vertical needle just as if he were tracking a preselected omni course. At some point on the

Capt Powell is now serving in Vietnam.

simulated trajectory, the horizontal needle was deflected. The pilot initiated a dive, keeping both needles centered, just as though he were making a full ILS approach. When a minimum safe altitude was reached, the pilot would terminate the dive and return to the initial point for another run.

The simplest way to show how effective this device was and how it operated is to describe a typical training mission.

Usually, two guidance centrals were emplaced on the bluffs surrounding the Fort Sill range. Each would select a target in the impact area and prepare the ground guidance equipment exactly as though a missile were to be fired. The guidance section leader, or person in charge of training, would select an altitude, heading (within $\pm 20°$ of the simulated firing azimuth), and an IP (initial point) for the trajectory simulator pilot.

When the ground equipment was properly prepared, the section leader would notify the pilot, by FM radio, to begin his trajectory run. The pilot then departed the IP on the assigned altitude and heading.

Shortly after crossing the IP, the amber lamp on the pilot's panel would light, indicating yaw transfer. This told the pilot that the ground equipment was transmitting directional control commands. These commands caused the vertical needle to deflect either right or left. The pilot then flew the aircraft on an intercept heading in exactly the same manner as intercepting an omni course line.

Just before reaching the terminal phase of the trajectory, the green lamp would light, indicating pitch transfer. This told the pilot that in approximately 15 seconds pitch control would be transmitted from the ground equipment. During the terminal phase, the pilot "flew" the omni-ILS indicator in the same manner as a full ILS approach, keeping close tabs on his absolute altitude and airspeed.

At a preselected absolute altitude the red lamp on the pilot's panel would light. This indicated that the warhead arming command had been properly transmitted from the ground equipment. Upon receipt of this indication, the pilot would recover from the dive and return to the IP for a simulated trajectory run for the second guidance central.

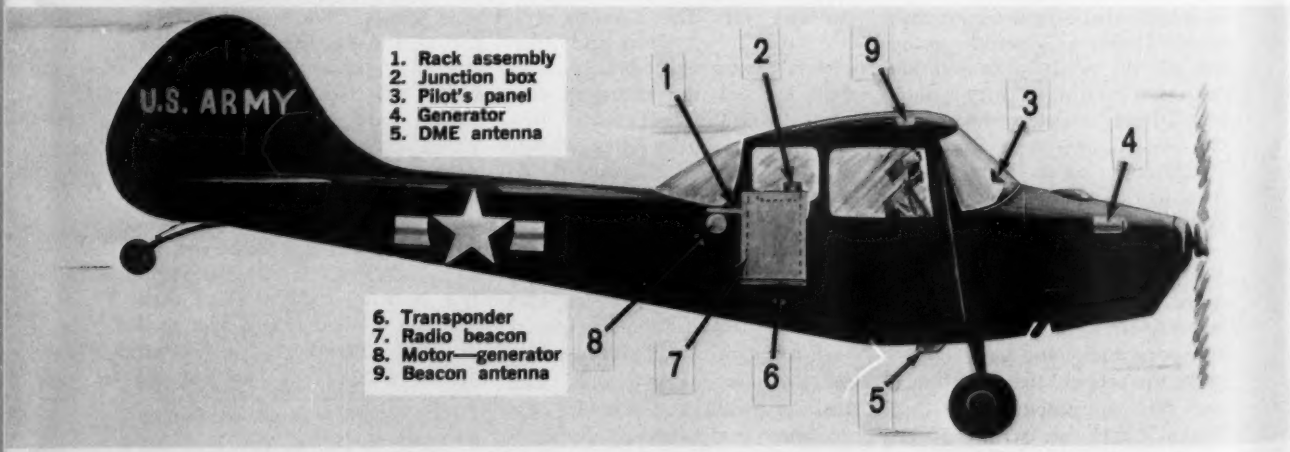
While number 2 central was conducting the flight, number 1 would select a new target and prepare for another simulated mission. Working in this manner, each guidance central could conduct an average of 2 simulated firings per hour, and have the satisfaction of seeing the results of their efforts.

The Bird Dog missile was born in the imagination of a group of resourceful individuals who were convinced that a device could be developed to eliminate the ground commander's training problem. Without a full understanding and appreciation of this problem the Lacrosse trajectory simulator might never have been developed.

Since Army Aviation's true role is support of the ground commanders during training as well as combat, how well do you, the Army Aviator, and your unit understand the problems of the organization you are supporting?

Can you and your unit rise to the occasion and develop other such unique uses of Army Aviation?

Missile Trajectory Simulator



Captain Robert B. James

Sorry– You're Not Carrier Qualified

IT WAS A typical muggy morning on 15 May 1965 in Santo Domingo, Dominican Republic. Captain Gick was flying a UH-1B on a courier mission to the *USS Boxer,* an aircraft carrier (Navy designation: LPH, Landing Platform Helicopter) cruising somewhere off the shores of Santo Domingo.

As was usual procedure he called, "Buzzsaw Control, Feet Wet from Army." This time, however, the reply was different. Instead of a vector and distance to the ship, Buzzsaw stated they could not take him aboard. Quickly the question went through the crew's mind—why? After at least six trips to Navy ships, why was the pilot now told he couldn't land?

Could it be because an Army Aviator tried to pull pitch while he was chained down to a ship one day? Could it be because an aviator from another Army unit had landed against traffic when four CH-34 Marine helicopters were carrying slingloads to San Isidro Airfield, thus causing all four to go around? Several possible reasons went through the captain's mind as he made his landing at the main division pad. Immediately after he reported to

the battalion S-3 and the assistant division aviation officer (ADAO), a check was initiated to find out why our aviator was refused permission to land. The reason given was that we were not aircraft carrier qualified according to Navy standards and that we had violated their ground rules on different occasions.

The battalion commander then initiated a request to the Navy to have all his aviators given the necessary training to become carrier qualified. Since an airmobile company from the 11th Air Assault Division was in the Dominican Republic at this time, arrangements were made to have both the 82d Avn Bn and the 11th AAD company take the necessary training.

On 21 May, the first group was flown to the *USS Boxer* by the U. S. Marines stationed on the ship. We received a very friendly welcome from the operations officer and were taken to the ward room for coffee and sweet rolls. This was the first food that did not come out of a can that we had received since we had arrived in Dominican Republic, and it was certainly a welcome sight to the aviators.

We then had a demonstration by the Marines on launching an entire flight. Later we found out that this was not a normal launching but a 50,000 accident-free hour flyby which we had observed. I must admit that many hours of formation flying were evident at this time.

We then toured the ship until lunch time, when we enjoyed some good Navy chow. This was followed by a thorough briefing by the deck officer of all signals, traffic patterns, Navy commo, formations, and assault waves used aboard ship. It is amazing how even a short briefing can bring out so many differences in SOP.

After the classroom briefing, the Marines again demonstrated all the maneuvers taught so that we might see them in actual practice. We then asked questions about anything we did not understand, had a cup of coffee, and departed to shore.

The next two days, other groups had a similar experience, except for the 50,000 hour flyby of course.

On 24 May, we were broken down into groups of four, UH-1B or D model helicopters, with two pilots aboard each. In the morning four aircraft went to the *USS Boxer* and four to the *USS Okinawa,* a smaller aircraft carrier operating with the fleet.

That afternoon and each morning and afternoon thereafter until 27 May, Army aircraft broke the peace over the ocean to advance into a new experience which may be beneficial to us in the future.

Training that usually takes weeks was completed in days. The carriers were cruising at distances from 1 mile to 20 miles offshore at all times and Buzzsaw Control would always give us a vector and distance to the ship. Upon arrival we were given a Delta pattern command. This means we were to circle the ship with left hand turns above 500 feet and generally were given assigned altitude due to a delay. We flew this Delta pattern for approximately 10 minutes when we were given a PREP CHARLIE (prepare to land and given spot number on ship).

At this time letdown is made to 400 feet turning crosswind, 300 feet turning downwind, and 200 feet and 60 knots prior to reaching 180° mark. Upon reaching the 180° mark (a point just forward of touchdown point and approximately 300 feet off to side of ship), a relatively steep turn and descent is begun and a call at 180° point is made. If we are cleared to land, we then receive a CHARLIE. Upon reaching the 90° point, the turn should be completed so the aircraft is parallel to the path of the ship. At this time you are actually flying sideways and slipping toward the ship, which is generally moving 17 knots into the wind.

Since the landing spot is 60 feet off the water, particular attention must be made not to get too low. You should clear the side of the ship by 10 feet and slow sufficiently to come to a 3-foot hover over your spot. A man in a yellow T-shirt called the LSE (Landing Signal Enlisted) gives all your signals. Careful attention must be paid to him because he gives two mandatory signals. One is waveoff (go around) and the other is hold (when on the deck). All other signals such as slow down, speed up, go left, right, or rearward, land, pick up to hover, and takeoff are given but pilot discretion is used.

If the copilot is at the controls on any approach, the pilot must hold his arm out the window so the LSE can move into the copilot's sight.

The most important difference between landing on land and on shipboard is that you should never watch the water. Vertigo will set in, and this could ruin your whole day.

From the 90° point watch the LSE and your touchdown point only. With this in mind, you will find no more problem landing as you would on a large football field.

After landing on designated landing spot, the usual procedure for individual aircraft is for two deck men in purple shirts to attach four chains to the helicopter prior to its going to ground idle. The LSE will then give you a cut

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Capt James is S-1, Hq, 82d Avn Bn, 82d Airborne Division, Ft Bragg, N. C.

signal and a thumbs up or down. You reply on aircraft status and then cut engine.

In case of a wave landing (two or more aircraft in formation break), a LSE will be in front of each parking slot.

When preparing to take off, the LSE will give the start signal. After you have reached takeoff rpm, he will give a tiedown remove signal to the tiedown man. These men will come in front of aircraft holding two chains each in the air. You acknowledge by holding up four fingers. This is strictly a safety factor. You then get a hover signal followed by a signal to take off, usually on side of ship you are parked closest to. You must go to the side rather than front in case of engine failure. The carrier usually outweighs the aircraft and you could get the worse part of the ram.

The requirement to become aircraft carrier qualified calls for 6 day landings initially and 2 day landings every 6 months to stay current. Night qualification is also 6 night landings plus 3 night landings every 6 months.

Now we are aircraft carrier qualified and can perform a new type mission for the Army. Although the carriers and Marines have moved out of Dominican Republic, we know that some day, for some reason, if we should have to work with the U. S. Navy again or if we are told we have an assault wave to a combat zone from an aircraft carrier, we have a feather in our cap. Current? Oh yes, it will probably be a problem to stay current with the lack of aircraft carriers in the Aviation Battalion TOE.

Little Ole Watermaker

Colonel Francis M. McCullar
Director, Dept of Maintenance, USAAVNS, Ft Rucker, Ala.

TO BE LOST in the desert without water is certainly a serious situation. But if you're lucky (or smart) enough to have a piece of clear plastic along, you don't have to worry about who is going to buy your next "drink." In 30 minutes, or less, you can build your own private still and then sit back like a "little ole watermaker" and watch it produce distilled water right out of the desert floor.

Two research physicists, Drs. Roy D. Jackson and Cornelius H. M. van Bevel of the U. S. Water Conservation Laboratory, Tempe, Ariz., came up with the idea for a desert survival still last year, and it met with immediate success.

A number of experimental stills were built in various sections of the Arizona desert. The lowest water output—in a particularly dry area—was just about ¼ of a pint a day. Other desert areas produced over 3½ pints a day.

The still is easy to build. Just dig a hole about 3 feet in diameter and 3 feet deep. Place a container (preferably plastic) in the bottom of the hole and spread a plastic sheet across the top. Push down the center of the plastic to form a cone sloping 25-40° from horizontal and aimed directly at the container (see fig. 1). Secure the

(2) spread plastic across top, (3) depress center to form

Photo story on constructing desert water still. (1) Place container in pit,

r Me!

A water still made with a sheet of clear plastic can save your life in a desert survival situation. It distills up to three pints of water a day out of hot desert sands.

sides of the plastic with rocks or dirt. If available, a tube can be taped to the inside of the bucket and run to the surface. This enables drinking directly from the bucket without disturbing the still.

Once the still is built, you'll be pleasantly surprised to see moisture forming on the underside of the plastic as the sun evaporates water in the ground—even in the desert. As air under the plastic gets hot, moisture from the ground evaporates and then condenses on the underside of the cooler plastic. In one or two hours enough water condenses to form drops. These run down the plastic and then drip off the point of the cone into the container.

In addition to being a survival device, the still has other military applications. Frequently, units deployed in the field find it difficult to obtain distilled water needed for battery powered equipment. One unit improvised—building a "full-fledged" still with copper tubing, a 5-gallon can, a wastebasket, ingenuity, and presumably a manmade heat source. The same results (at least as far as distilled water is concerned) can be obtained with the sheet of plastic.

Department of Tactics at the U. S. Army Aviation School, Fort Rucker, Ala., is running experiments with the plastic still. Plans call for including techniques for constructing it in the School's survival POI. Also, appropriate Army research agencies have expressed keen interest in the still, and there is a strong possibility that components for a plastic still will be included in standardized survival kits in the near future.

Consideration is being given to the type of container to include in the survival kit. Perhaps the aluminum container housing the survival kit may be satisfactory. Other considerations are waterbags, the plastic sheet itself, aluminum foil or other waterproof material formed into a container over rocks and/or dirt in the bottom of the still.

form cone, (4) leave rock in center and secure sides.

(5) Plastic tube allows drinking without disturbing still construction.

WATERMAKER

Initially two stills were built at Fort Rucker—one by personnel at the Department of Maintenance and the other by a slightly overweight AVIATION DIGEST writer. The DOM still was built according to specifications in figure 1. It was in bright sunshine all day and produced about 1/2 gallon of water in 22 hours.

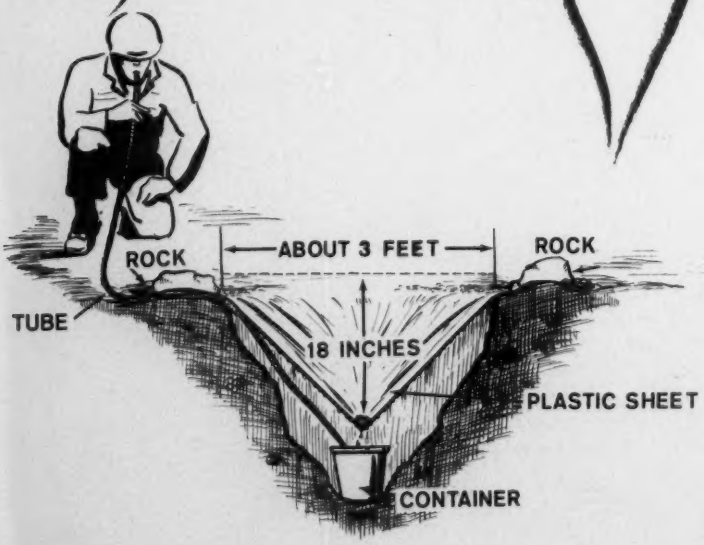
The DIGEST still, at half the size of DOM's and in the shade for 2½ hours in the afternoon, produced about 1 pint in 22 hours. Water samples from both stills were examined at the U. S. Army Hospital at Fort Rucker. Neither showed pathogenic bacteria growth. In other words, both were fit to drink.

Depending on circumstances, a number of common sense practices will help produce a clearer yield of water. The rim edge of the pit could be covered with plastic or other material so the plastic sheet stretched across the top will not touch the ground. Condensation forming at the edge of the sheet then will not touch the ground before rolling down the cone to the container.

Also, during initial experiments at Fort Rucker a few bugs managed to crawl into the pit and find their way into the container collecting water. Although the bugs did not contaminate the water, they could have been kept away by smearing a band of lubricating oil around the outside of the container.

Some debris managed to get into the water during the experiment with the smaller still. It did not contaminate the water, but in an actual survival situation it would be wise to strain the water through a clean filter, such as a gauze bandage, which usually can be found in survival kits. Of course one should use an iodine pill (if available) in *any* water collected in a survival situation. If salt, brackish or polluted water is available, it can be poured into the hole and will be distilled into drinking water.

Drs. Jackson and van Bevel also conducted experiments to determine water yields using various types of soil as a source and with cut up desert vegetation supplementing the source.



In the first experiment, *stills 1 and 2* were in loam soil with an initial water content of about 18 percent. They produced an average of 3.6 and 2.9 pints of water a day for five days. The other three stills were in desert soil containing 2 to 8 percent water. *Stills 3 and 4* were located in wash or depression areas where water would collect during rain and averaged 2.1 and 1.6 pints a day. *Still 5* was deliberately placed in an unfavorable area of coarse sand in which water would rapidly drain away. It averaged .25 of a pint a day.

In the second experiment using live desert vegetation, six stills were placed in desert sand with an initial water content of 3 percent. Over a five day period the still with *cholla cactus* averaged .59 of a pint of water a day; *saguaro cactus*, 2.5 pints; *creosote bush*, .33 of a pint; *prickly pear cactus*, 3.1 pints; *barrel cactus*, 3.4 pints; and *soil only*, .36 of a pint.

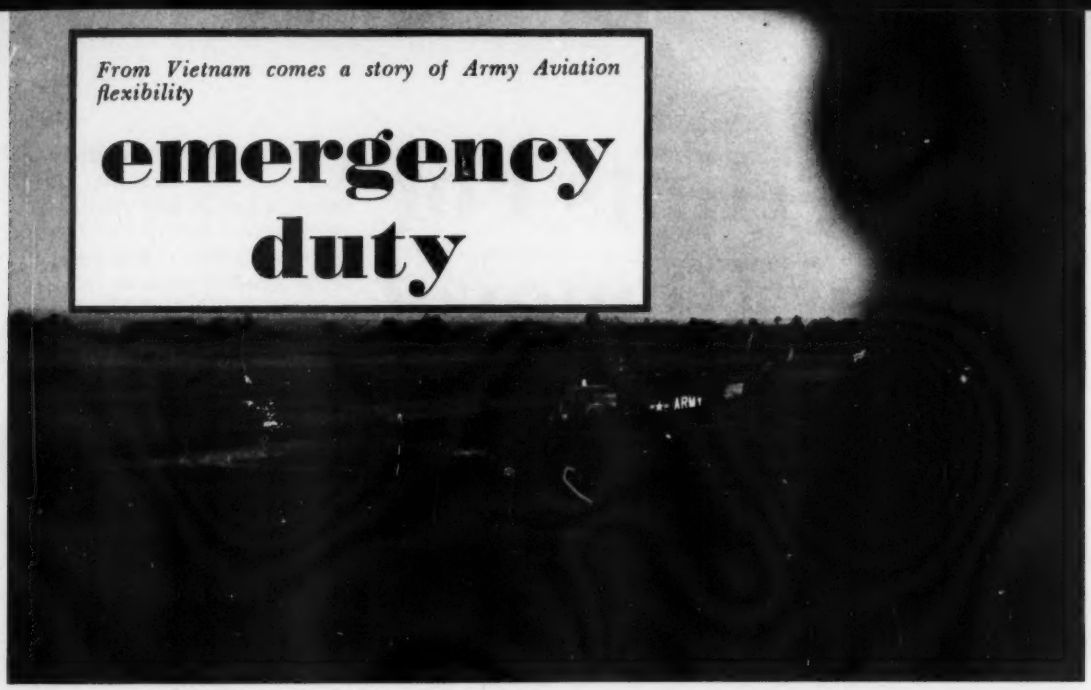
Before being cut up, the barrel and saguaro cacti were about 40 cm tall and 20 cm in diameter. Vegetation in each of the other stills should fill the pit but not crowd the container nor touch the plastic sheet. In both tests, after five days water yields decreased. This is easily adjusted by moving the still.

The size of the still in figure 1 is considered the most practical. Larger sheets of plastic and larger holes would yield more water, but making several holes instead of one large one would be much easier.

A secondary survival use of the stills should be noted. Small animals can crawl onto the top of the plastic sheet and find it too slippery to crawl back off. When you're starving, barbequed lizard may look pretty good.

From Vietnam comes a story of Army Aviation flexibility

emergency duty



IN THE EARLY morning briefing members of the 197th Aviation Company's "Playboy" armed helicopter platoon learned that Viet Cong elements had ambushed an ARVN battalion and overrun a small town.

The platoon's mission was to fly armed escort to the "slicks" (helicopters without rockets and machineguns) which were going to evacuate the dead and wounded.

The platoon got on station shortly before 0900 and Vietnamese planes were dropping bombs all over. They did not receive much fire because they went in on the deck—low and fast. A 57mm recoilless rifle was firing into the town and the VCs had at least three .50 cal machineguns set up in the hamlet.

Calls for med-evacs had been coming in all morning, and an American advisor was reported still missing in the area. A secure landing zone could not be established for the ships.

Meanwhile, forward elements of the 2d Battalion, 7th Regiment, Fifth ARVN Division arrived on a road clearing mission to secure the way for a large convoy. As the troops moved into town heavy mortar and automatic weapons fire rained down upon them from Viet Cong positions on three sides of the village.

"The mortars started blasting us . . ." recalled one Army advisor, "they knocked out our communications; we couldn't make contact with our rear elements. We sent an interpreter to get the word through, but the VCs stopped him."

As the town was overrun, all but two of the American advisors managed to escape the ambush and call for assistance.

"Playboy" platoon accepted this additional mission of medical evacuation. "After a few passes over the town," one Army pilot recalled, "we dropped in by several burned out armored personnel carriers."

"I hadn't expected so many wounded friendly soldiers," added another platoon aviator, "and 'Playboys' aren't built for evacuations—or so we thought."

Into his ship came four ARVN wounded, loaded with weapons and combat gear. Then appeared the American advisor who had been given up as lost. Just as the ship was about to leave station, another advisor turned up. The casualties made quite a load so the spent rocket pods were jettisoned. Rising slowly, the Huey edged around smoldering APC and took off.

Another UH-1B pilot with a load of seven ARVN wounded, along with their equipment, took advantage of the northerly wind being funneled toward his copter by the converging forest walls. Dodging the APC in his way, the pilot made a running takeoff and successfully evacuated the battered soldiers to a receiving station.

Applauding the help of the 197th, one of the rescued advisors told his side of the tale. "We escaped this morning to Lai Khe, about 5 miles to the south, an area noted for its support to the Viet Cong, and we feared the worst. But shortly after a radio call for help, the choppers came and evacuated us. There was barely enough light to see by, but those pilots did a darned good job."

Hints For Snow Removal

William H. Smith

CIVILIAN AND military airports in northern United States, Canada, and Alaska have one common enemy—snow. When the beautiful white fluff decides to settle down it plays no favorites. It will blanket all fields alike, regardless of kind, shape, or size, covering runways and lights and

making operations downright dangerous.

Large civilian and military airfields have all sorts of fancy equipment for snow removal. This equipment is usually so efficient that the whole field area can be cleared, allowing aircraft to land and take off in safety and comfort.

But smaller airports, and this includes many Army airfields, do not have specialized machines and cannot clear large areas easily. Heavy snowfalls may call for much backbreaking work with improvised equipment. Thus only absolutely necessary areas are generally cleared.

The Air Transport Association of America has attempted to assist the smaller civilian airfields in their snow problem by publishing a handbook* on snow removal. Along with handy hints, the booklet gives the pertinent measurements of individual airline aircraft. The association feels the measurements have an important bearing on clearances needed for snow, ice, and other objects on the ground.

The handbook gives a diagram which is a generalization of the height of snowbanks acceptable for airline aircraft operations.

If the cleared area is narrow or operational conditions such that aircraft are expected to move along the very edge of the cleared area, the bank height must be less than given in the handbook. Also if the aircraft are using wing tanks, the banks must be even lower. Another reason to reduce the height of the bank is to permit heavily loaded aircraft which sit lower to the ground to clear snowbanks and drifts.

The association recommends that snow removal crews begin work when dry snow reaches 2 inches and wet snow 1/2 inch. Continue clearing until the snowfall stops. When clearing is finished, not more than 1 inch of dry and 1/2 inch of wet snow should remain on the runway.

Runways should be cleared first. They should be cleared to a width of 150 feet for daytime use and full width between runway lights for night operations.

If it's impossible to clear to the runway lights, alternate means of runway lighting should be provided, such as flare pots or flashing battery powered lights. Portable runway lights may be placed on top snowbanks provided they are visible at cockpit height.

Taxiways are next on the priority for clearing, and ramps and aprons follow. Taxiways should be cleared full width for day and night operations.

Heliports are not mentioned in the Air Transport handbook. Army personnel faced with the problem of helicopters and snow can follow the same general rules mentioned above in clearing pads. Clear helipads at least 20 feet wider than the rotor diameter of the largest helicopter using the pad.

Loose snow is particularly troublesome. The downdraft produced by the helicopter rotor picks up the snow and visibility deteriorates. Sometimes loose snow may be blown away with a helicopter, but Army personnel report limited success with this method.

Helicopters can touch down on a snow blanket; however, there is danger of the gear sinking to different depths, causing banking. To eliminate this danger, logs may be used as a pad when the snow is too deep to clear. Crisscross two layers of medium sized logs and tie them securely with rope. Be sure the logs are about the same thickness and make a level pad.

These are only a few suggestions for clearing snow from airports. Airport personnel responsible for removing snow should take into account local factors which necessitate variations from these suggestions.

*Air Transport Association of America; 1000 Connecticut Ave., N. W., Washington, D. C.; Snow Removal Aircraft Ground Clearance Measurements and Other Information, September 1962.

How Well You Are Prepared

Brigadier General William W. Spruance
Assistant Adjutant General for Air, Delaware

THE PURPOSE OF my standing here before you today is to tell you about my experiences in a near-fatal crash in a T-33 about four years ago when returning from Colorado Springs. If you are interested in a few clues on how to cheat the Grim Reaper, pay attention—but if not, and you don't give a damn, just go to sleep and you can stay out of the office for an hour or so. I will try not to disturb you by talking too loud.

Well, I was with Snapper McCallister in a T-bird out there in the Springs for a business meeting. Colonel McCallister was flying the aircraft—I'm not a T-bird pilot. I'm a 4-engine jock. I figured that when I started flying the Gooney Bird that I was taking a maximum risk going from four engines to two, so I wasn't about to go back to one, so I let him fly the machine.

At the time I had a fighter outfit and I was the Chief of Staff and Adjutant General for Air. I figured that I should know what makes fighter pilots tick. Some of it was rubbed off on me from McCallister, and I sort of have an idea of how you people operate. Mac was a pretty darn smart pilot—one of the dive and zoom types who made the change to the all-weather professional jocks which you guys are today. If I had my life to live over, I would certainly have selected him as a pilot to go any place at anytime.

Back to the flight. We were scheduled to get off the ground fairly early for our return to Delaware by way of Scott. It was one of those days in which we should have stayed in bed. Mac was late getting out to the field with some excuse about running out of gas. I was careful not to chew him out because I am not one of those generals who believes in going around raising hell with an airplane driver. You get them shook up, they're apt to kill you if you don't watch it. So I'm real friendly with them and wait to chew them out after we get home.

We got off late and leaped out of Peterson for Scott. We got the flaps up, and fuel started streaming out of the right main wing tank. We aborted, came back to Peterson, had a little chat with the transient alert types.

They topped us off, and back in the air we headed for Scott. We arrived without incident, except by now it was a dark, hot, muggy night. Those of you who have spent any time in the St. Louis area in midsummer know how miserable it can be. Well, I took my jacket off before takeoff on the

This vivid personal survival experience is adapted from a two-hour safety address delivered by General Spruance at NORAD, Ent AFB, Colo. It was published by INTERCEPTOR magazine in the July 1965 issue. Permission has been granted to reprint the account for DIGEST readers.

[illegible]g: T[illegible] is where I made my first mistake. I [illegible]t and [illegible]eating and didn't want to catch cold [illegible] altitude. If I had kept the jacket on, [illegible]e provided insulation from the fire [illegible] was to be caught in for a few minutes. It [illegible] have greatly minimized the burns on my [illegible] so that was my first mistake.

We started taxiing out and of course went through the regular procedures on the checklist. Now when I'm riding [illegible] in a T-33 the seat belt and shoulder harness [illegible] more than just strapped in. I always [illegible] I don't have anything that will prevent me from getting my feet on the instrument panel. I did this in my automobile also to make sure it can brace me for an impact. Put your legs on the panel, [illegible] that will help you stay in [illegible] sudden deceleration. Next I check and make sure that my hands can reach the panel so I can brace myself with them. And finally, during this check, I put my head back hard against the headrest. I found out later that this was to be my second mistake.

If you are going to impact you should put your head forward with your arms and legs out against the instrument panel. If your head is back, you are going to get a whiplash. This may result in a spine injury or, as in my case, it may tear the helmet off your head. This procedure I've just talked about was a little exercise I used to go through before each takeoff.

Now it is hard for me to get into a mental attitude to think that something is going to go wrong. I think this is one of the hardest things for anyone who really loves to fly to do. One way to help you make this mental adjustment is to read some of these horror publications, [illegible] some of the flying safety magazines. You really have got to think about the possibility of pranging [illegible] and get prepared for it. Believe me, it [illegible] pays off.

Of course we checked pins [illegible]ward and canopy. I rechecked my chin strap—[illegible] and since I wasn't going to make the takeoff, [illegible] the seat all the way to the bottom. I always figured if we were to flip over for some reason, I didn't want my head sticking up there like a goose and get smashed in. My last check was my gloves all the way up, and we took the runway.

Down the runway we went and off into the black night. About the time we got the gear up and the flaps were coming up, the engine quit. No snap, no crackle, no pop, no nothing. It just completely unwound to zero.

Mac comes over the interphone and says, "Boy, we're in a helluva fix, we've got to get out of this." This did not mean to me to eject. We had covered the procedures and terminology that we would use in event of an ejection and this wasn't it. We were at about 150 feet in the air, going pretty slow, and going downhill. Within seconds we hit the first tree, 110 feet above the ground. I had a chance to go through my procedures again—checking the chin strap, visor down, seat belt and shoulder harness as tight as possible and real uncomfortable.

I braced myself as soon as I heard the first "whap" on the bottom of the fuselage. The next thing that happened was everything went red. At

first I thought of fire. Later I found out it was nothing but a redout when my head was snapped forward. There was a deceleration force estimated between 9 and 13 g's. My helmet went right off my head in spite of the fact that it was well adjusted and on tight. The plexiglass of the canopy just fractured and came completely out of the frame. My helmet was actually outside the cockpit.

The seat belt and shoulder harness kept me tight in the seat. If you guys don't have seat belts in your cars, there isn't much I can say for you. Anybody who doesn't have a seat belt and wear it all the time, in my estimation, is an idiot. When I get in a car which doesn't have a seat belt in it, I sit behind the driver. When the guy says, "What are you doing back there?" I say, "When you go through the windshield, I want you to make a good clean hole so that when I go through, I won't get cut." Why, if my kids get in the car with the door shut and no seat belts on, it costs them a buck. Not tomorrow, but right now. They either get out of the car and get a buck or they have to work it off. I charge them a buck on the spot and it really pays off.

Back to the auger. Just before I lost sight because of the redout, I looked at the instrument panel and saw 125 knots on the airspeed indicator. All became red and I passed out. When I started to come to, the first sensation I had was a feeling of warmth. I felt like everything was great, a sense of wellbeing. It was the kind of sensation that you get in the pressure chamber when you take your mask off. That's the feeling I had, and from my pressure chamber training, this was a danger sign that something was wrong.

The next thing I thought of was I had to get out of here, or I wouldn't get back to any cocktail hours with my wife and kids. When I was in General Patton's Second Armored Division early in the war, one of the things that he trained us to do was that when you are in a bind or any kind of shock situation, do something—even though it may be wrong. The chances of your doing something wrong and having it actually hurt you are a helluva lot less than the chances are if you just sit there, freeze in terror, and do nothing.

Gloves. I had my gloves on during the crash. Anyone who flies . . . without gloves . . . is another plain idiot

So I was motivated to do something right away. I was trained to be able to react automatically, because I had gone over in my mind many times what needed to be done in any situation. In spite of the fact that when I woke up with this warm sensation, and completely on fire (there was a mass of flames all around me and I could hear my hair burning on my head just like a crackling grass fire—looking down both sides of the cockpit was like looking into two afterburners), I reached down into one of these ABs to put the pins in the seat.

About then my logic took over and said, Jeez, what the blazes am I doing fooling with these things when those dynamite caps are going to cook off and launch me into the boondocks within seconds. I started to undo my seat belt, and my hands were so badly burned that I permanently injured my little finger trying to take hold of the metal. But still according to standard procedure, though I was burning like a torch, I was just as careful as I could be about getting out of the seat without those pins in place. And I remember taking the chute with me so that I could use the canopy to wrap up in and put the fire out.

So I got up with the chute hanging onto me and looked around. On the left side I could see noth-

Note unburned area around wrist where overlapping flight suit sleeve and glove prevented serious injury

I braced myself as soon as I heard the first "whap" on the bottom of the fuselage. The next thing that I remember was everything went red.

ing but a mass of flames, the front and the cockpit were full of fire and I could see McCallister doubled up and completely flat with his head down in the bottom of the cockpit. There was no motion from him. (Later I learned that he had been killed on impact.) Over on the right side I saw a creek and that the water was carrying the fuel off downstream. I turned around and sat on the edge of the canopy rail. This was my first sensation of pain. It was so hot that I got a first degree burn on my tail. I rolled over and sorta half dived and half fell into the water (you just don't execute any point winning halfgainer with a parachute on you and you are on fire). I hit the water and went to the bottom like a rock (we were in about six feet of water).

The next sensation was pain. I reached up and could feel a fair sized hole in the back of my head where it had struck the seat's headrest on the rebound. I came to the surface and began wallowing around doing the butterfly breast stroke to keep the burning fuel on top of the water away from me. Down to the bottom again. I discovered since I didn't have adequate religious connections to walk on top of the water, the next best thing was to walk on the bottom and go uphill. That's the technique I used in this instance and made my way up on the bank.

Although General Spruance's hand and arm were badly burned, they were restored to full use through the miracle of modern medicine and treatment

There I started to pull the "T" handle on the chute to dump the canopy. That's the sorriest rig I've ever seen. I didn't have enough strength or mobility left in my fingers to get hold and pull it. The old "D" ring would have been no sweat. As it was I wasn't on fire because of that swim I just had, and really didn't need the canopy to roll around in.

While I was yanking at this "T" handle and not able to get it out, a bunch of civilians arrived at the scene. I figured that the aircraft might blow up any minute so I began shouting at them to get away from the fire. That's how they found me. They came over and I asked them to get the chute off me. Just try to explain how to take hold of the catch on the leg strap while in a state of shock. You've got one helluva problem. I asked a medic to cut the harness off me. They finally found my knife, cut the chute off, and got me in the ambulance. I started getting cold so they gave me some shots and I don't remember much of the ride. Later I found out that on the way to the hospital the chaplain administered the last rites of the Catholic church. That's probably the reason I survived, because I'm a Presbyterian, and the Catholic rites wouldn't take.

Over the next two years I went through over 30 surgery procedures to get patched up. I'm still not A Number One, but I'm good enough to get my FAA private pilot's ticket. Many things have enabled me to be in the relatively good shape that I'm in today. *Gloves.* I had my gloves on during the crash. Anyone who flies around without gloves in my estimation is another plain idiot. Any of those old wives tales that they give you about gloves getting soaked with kerosene, crinkled up and are no good, is nonsense. Mine had just about as much JP-4 as yours. If I hadn't had those gloves on, I would be a double arm amputee—that is, if I had survived at all. So it really behooves you to wear those things.

Now the reason I wore gloves was that one time down in Savannah our outfit was flying F-86s. One

HOW WELL YOU ARE PREPARED

of our young second johns taxied down the ramp, middle of summer and hotter than the hinges of hell, with his sleeves rolled up, elbows on the canopy rail, and no gloves. General Milliken remarks to me, "Well, I don't usually beef at other people's troops, but this guy needs to learn." So this second john gets out of the cockpit and the general approaches him with a story about when he was in the RAF. He related that when they brought back the first casualties of the Battle of Britain they showed the stumps of the arms of guys who had been burned and were not wearing gloves. They showed the legs and stumps of those who had not been wearing boots. From then on he started wearing gloves and expected everyone else to do so.

I was so impressed by this that I started wearing gloves. I hadn't worn gloves all through WW II. I figured gloves were for the wintertime to keep hands warm. I started wearing gloves because of what General Milliken said to this second balloon. This points out the importance of all of us making sure everyone uses his personal equipment and not being afraid to sound off when we see something amiss.

Next is *boots*. If I had low cuts instead of boots, I would be a double leg amputee. Low cuts in a bailout or any kind of fire situation are a complete waste of time. I had my boots on, and thank God I did. I would have burned off both my legs if it weren't for them.

Finally, I can't say enough for the treatment the Air Force gives at their hospital in San Antonio and the help from the Army burn center. There they have, without doubt, the greatest concentration of knowledge on burns in the whole world. They were able to save my arms and hands after many experts said it couldn't be done.

Then there is always the will to live. When things look real dark, it's easy to throw in the towel and call it quits. But the human body is a remarkable thing that can come back from over the brink and recover. It can and will, if you have the proper mental attitude and the guts to stick it out. The doctors, chaplains, and our medical technologists can perform miracles if you let them. In the final analysis, it's up to you—what you wear, and how well you are prepared.

Increased commitments in the Republic of Vietnam call for an intensified program to support the limited type war being waged to halt communist aggression. The U. S. Army Limited War Laboratory at Aberdeen Proving Ground, Md., responds with its "built-in," quick reaction research capability.

Limited War Laboratory

Richard K. Tierney

HA! WHEN ANYONE took a shot at me, *I knew it!*"

Many an Army Aviator back from the Republic of Vietnam has echoed these words. But during a recent test it was proved that Army helicopter pilots were aware of only 10 percent of the small arms fire directed at them. To find a way to detect the other 90 percent—and the direction from which it is coming—the Army turned to its Limited War Laboratory, which boasts a "built-in" quick reaction capability.

Established at Aberdeen Proving Ground, Md., in 1962, the laboratory reports directly to the Chief of Research and Development. The lab is "loaded" with scientists and engineers, and it also has military personnel who are veterans of the limited type war being waged in Southeast Asia.

Limited War Lab projects are expected to be completed in 18 months or less. Thus basic research is skipped and lab personnel conduct applied research, usually with off-the-shelf hardware. Much of this research is accomplished with assistance from laboratories organic to the Army Materiel Command, which also provides housekeeping type support.

For detection of small arms fire, Limited War Lab personnel are working with a detector shaped somewhat like a huge plate weighing less than 20 pounds (fig. 1). Current plans call for installation only on Hueys.

The detector will warn the pilot of small arms fire with both audio and visual indications, the latter being either a steady or flashing light. Direction of fire will be indicated by a light in an instru-

Figure 2. Battery operated electroluminescent tape comes in five colors. Enough tape to illuminate a 2,000 foot runway, a taxiway, and a helipad weighs about 50 pounds.

Figure 1. Small arms fire detector installed on the UH-1

ment on the panel. It is hoped the detector will be in the hands of the troops in about 18 months.

ILLUMINATION

Three illumination systems are being studied at the Limited War Lab and should be made available in about 12 months. One is electroluminescent tape 1¾ inches wide (fig. 2). The battery operated tapes come in 36-inch strips, each containing one of five colored miniature lights (green, blue, white, yellow, and red).

It is probable that a 2,000-foot runway lighting system can be contained in a kit weighing 50 pounds or less. The kit would contain 40 strips—20 for use on the runway, 10 for taxiways, and the rest for a heliport. Batteries weighing less than 1/2 pound each may light each 30 inch section, or one larger battery may take care of the whole system.

In a typical mission, a pathfinder could jump into an area with eight strips—enough to bring in an aviation unit which could set up additional belts as needed for taxiways, heliports, and parking areas.

Another illumination system is the chemiluminescent panel. This consists of a chemical compound sealed in a 10" x 10" panel. When admitted through a valve or tear strip, air causes the compound to glow brightly for about 45 minutes. Each panel is designed to be visible from 500 feet at a slant range of 2 miles, but during evaluations at the Limited War Lab has been seen from up to 5 miles.

The third illumination system is also a compound that glows for about 45 minutes when exposed to air. Known as a "beer can panel" it is a small disk about the same circumference as a beer can. It has an adhesive back and is easily stuck to a tree, truck, helmet, etc.

SMOKE

An adaptor for the XM-3 rocket kit enables a helicopter to lay a dense smoke screen 1,000 meters long (fig. 3 and 4). The entire system weighs 118 pounds and holds 168 smoke grenades on each side of the aircraft (144 if the grenades include parachutes). This adaptor already has been used in the Republic of Vietnam.

Signal smoke markers with parachutes have been developed at Special War Lab and are now in use in Vietnam. Each marker weighs about 7½ pounds and contains three AN-M8 grenades which ignite in sequence (when markers are attached together they also ignite in sequence).

Smoke markers can be launched by hand from aircraft flying at speeds up to 250 knots and at altitudes of at least 100 feet or from a dispenser that can be mounted on UH-1s or O-1As (fig. 5 and 6).

Grenades function satisfactorily on any type of terrain and provide white smoke for at least 5 minutes. Red, green and yellow markers are under development.

Still under study is a tiny "thumbnail" size can whose contents will burn for about 13 seconds and give off billowing clouds of red smoke, capable of being seen at 1,000 feet and at a slant range of 1,500 meters. Each can, or cartridge, weighs about 1.1 ounce and contains a pellet wrapped in .001 aluminum foil (fig. 7). It is ignited by a scratch block or ignitor pellet. Yellow, green and white cartridges are under development.

Figure 3. An adaptor to the XM-3 rocket kit converts it into a smoke dispensing unit. Each adaptor holds 168 smoke grenades

Figure 4. The adaptor enables a helicopter to lay a dense smoke screen

Figure 5. Long burning smoke markers used to mark targets of opportunity can be launched by hand

Figure 6. An electrically operated tube type dispenser for the smoke marker can be mounted on UH-1 and O-1A aircraft

In the navigation field, Limited War Lab personnel are participating in a tri-service (Army, Marine, and Air Force) test of a drop zone beacon (PRT-7) weighing about 17 pounds. Evaluators have had no difficulty locking onto

Figure 7. The thumbnail smoke cartridge comes in a can smaller than 35 mm film can, yet it puts out enough smoke to be seen by an aircraft at 1,000 feet

LIMITED WAR LABS

Figure 8. A safe cargo/personnel lowering device has been developed for use from hovering helicopters

the beacon at 500 feet and 25 miles. It has both automatic and manual key capabilities.

A line descent system to lower personnel from a hovering helicopter (fig. 8) is under study. Designed to handle 500 pounds of cargo, the 7¾-pound system includes 150 feet of nylon rope, personnel harness, governor and governor hook, rope hook and carrying case.

One man can operate the system, controlling the rate of descent by applying a small amount of pressure to the rope. A person also can be lifted up if the helicopter is equipped with a power hoist.

An air-transportable service platform which rests on the center area also has been tested with this system (fig. 9). It weighs 250 pounds and provides a hoist for raising personnel and/or equipment from the ground. Initial tests of the entire system indicate it has a great potential.

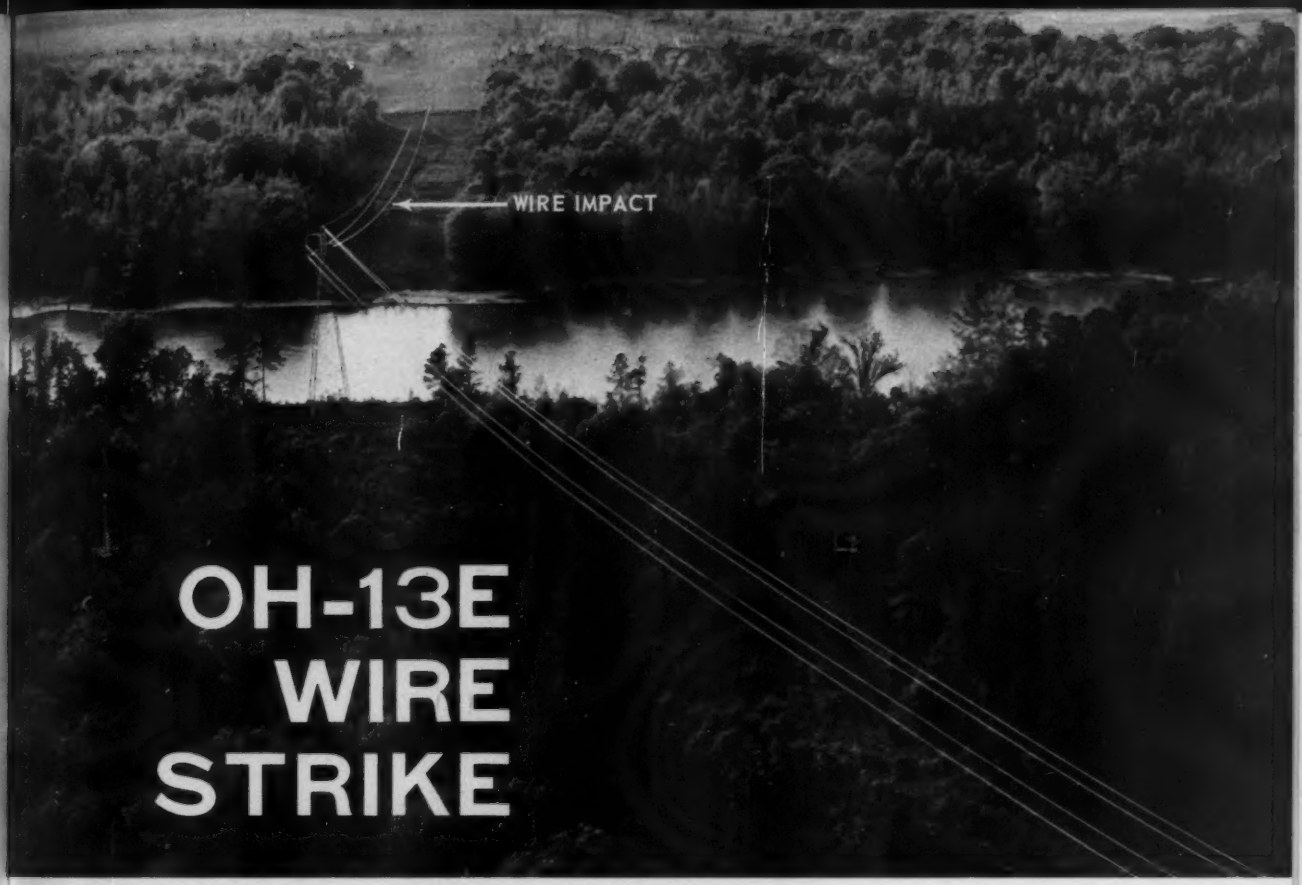
One of the most interesting projects studied at the Limited War Lab is the canopy platform for landing on trees. Two net-like "blankets" of 1/4 inch stainless steel cable are rolled up on separate reels that can be sling loaded under a helicopter. Each blanket is equipped with hooks on the ends to catch the trees and allow unreeling of the net into a strip 200' x 20' (fig. 10). The center of each strip consists of about 60 feet of 6 inch mesh while the extremities are 2 foot mesh.

The two strips of net are laid on the treetops one across the other to form a cross. The center area where helicopters load and off load is 18 feet in diameter.

The Army's Limited War Laboratory is far from limited in ability or capability. It has already demonstrated that it can quickly analyze problems our armed forces are encountering in limited type wars and quickly come up with the answers.

Figure 9. A service platform also comes with the system. It provides more stable support for heavier equipment.

Figure 10. Paying out canopy platform for tree landings



OH-13E WIRE STRIKE

View from east side of river, showing powerline, towers, and impact point

AT APPROXIMATELY 1410 hours, the dispatcher at an Army airfield received a call from a county patrolman that a helicopter had crashed in a river just south of the reservation. The secondary crash alert system was activated and the tower requested helicopters flying in the area to assist in locating the wreckage. Medical evacuation helicopter was alerted and departed for the general area. The operations officer and aviation safety officer were notified. They departed for the crash site immediately. Dragging operations were started and concentrated in an area downstream from broken powerlines where an oil slick could be seen rising. The investigation board was flown to the site by helicopter, arriving at approximately 1600 hours.

The pilot of the crashed helicopter called the tower for takeoff instructions and was cleared for hover and takeoff to the south at 1329 hours. His probable route of flight was downstream along the river. At approximately 1340 hours, he was seen circling low over some fishermen. He then proceeded downstream and hit and broke a seven strand, high tension power cable suspended approximately 120 feet above the river. The aircraft struck the water upright, slightly nose low, in a shallow left bank. Pieces of the rotor blade were found under the powerline on the west bank. The remainder of the wreckage was found on the river

crash sense

Coast Guard buoy tender raised main body of wreckage from river bottom

bottom opposite a marker buoy.

There were no surviving direct witnesses to the accident. Immediately before the accident, several people saw the helicopter flying low and circling upstream. They then heard two loud noises.

Positive identification of the aircraft was not made until the following day. However, by nightfall, it was apparent that the crashed helicopter was the one that had departed the airfield at 1329 hours. Aboard were the pilot and one passenger. Recovery operations were seriously hampered by poor visibility in the muddy river. The wreckage was located in about 45 feet of water at midstream. Attempts to raise it proved unsuccessful. At 0200 hours, a diver from the county rescue squad secured a line and buoy to the wreckage. But the divers were running out of compressed air and operations were suspended until daylight.

On the following morning, additional divers from an Army SCUBA club helped attach lines to the wreckage. The severed tail boom provided positive aircraft identification. Further attempts to raise the wreckage with available equipment were unsuccessful and the Coast Guard was called to assist. A buoy tender succeeded in raising the main portion.

Extensive dragging operations were carried out in the area of the crash, and both river banks were searched. The fuel tank, tail rotor, a section of the tail boom, and sections of the door frames were not recovered.

Interviews with witnesses revealed that the flight altitude was low and the aircraft generally followed the river. A portion of the flight was at and below treetop level. Here is what one witness said: "I was fishing in the general area of the crash in a small cove. The first time I noticed the helicopter, I was cruising down river, heading for the cove. He came in low over the top, circled me, and went back upstream. At this time, I went on down river and pulled into a small cove near the powerline, approximately 100 yards from it. I sat there for 5 or 10 minutes and the helicopter came back over me in a circling motion, real low. He came out of the cove I was sitting in and went back up river again. Then he came down river near me real low, and headed on down river.

"About a minute later, I heard this loud crack, like lightning had struck something, and I heard the explosion right after it. I pulled my lines in, went down river, and saw the rotor blade and broken powerline with the woods on fire to my right. I went on down river and picked up some of the debris from the helicopter—part of a blade, a seat cushion, gloves, and some pads."

Earlier in the day of the accident, flights in the aircraft had been satisfactory. No discrepancies had been written up by previous pilots. Analysis of fuel samples taken from refueling tankers as soon as the crash was reported showed no significant contamination. The engine and transmission were flown to a laboratory for analysis. Disassembly showed no signs of engine or transmission malfunction.

Arcing marks were found on the right aft cabin door frame and yellow main rotor blade. These, along with copper traces found on a portion of the right forward door frame, indicated the cable first came into contact with the bubble and then the main rotor blade. It then hit the instrument console and parted. Scars on the helmets also indicated the cable's path. Additional arcing marks were found on the tail boom aft of where it was apparently cut by the yellow blade.

The instrument panel was inspected under black light in an attempt to determine power settings at initial impact. No significant findings were made, probably due to prolonged immersion in the river.

The pilot was both fixed and rotary wing rated. He had flown nearly 1,600 hours, including 480 hours in helicopters. He had flown a total of 76 hours in the past 6 months, 6.8 hours in OH-13s. On the previous day he had flown an instructor pilot checkride for OH-13 type helicopters. He was attending a ground course and had flown mainly for proficiency and annual minimums.

Ceiling and visibility were unrestricted. The wind was from the south at 8 knots, gusting occasionally to 16 knots. Weather was not a cause factor.

A sectional chart showing the powerline the aircraft struck was in the aircraft at the time of crash.

The unit SOP called for all assigned and attached aviators to be briefed by the standardization pilot, aviation safety officer, and aviation staff officer before local checkout. This aviator had attended the required briefings. He had also been issued a copy of local regulations by the standardization division.

Analysis: The pilot was well qualified and operational in the type aircraft. He was on an authorized mission. However, his flight altitude was below that permitted by federal air regulations, Army area regulations, and local regulations.

Cause: The primary cause was found to be flying below authorized minimums. A contributing cause was inattention or preoccupation which prevented the pilot from seeing the wires in time to avoid them.

Moral: If you're going to dance, be prepared to pay the piper.

UH-1D FOGGED APPROACH

With a pilot, copilot, and three passengers aboard, the UH-1D was returning to a forward helipad after a flight to observe night operations. It arrived at the helipad at approximately 0600 hours. The area immediately over and around the helipad was covered with light fog, but the lights on the "T" and the parked aircraft could be easily seen from above. Depth of the fog was estimated to be approximately 150 feet.

The pilot used a left hand traffic pattern and set up an approach to the "T." He momentarily lost sight of the "T" on final approach and was too high to complete the approach when he saw it again, so he made a go-around. His second approach, this time from a right hand pattern and

different heading, was similarly aborted. On his third attempt, the pilot set up another left hand traffic pattern. The copilot said he could see the "T" and took control. After he turned on final, the pilot said that he could see the "T" and apparently placed his hands on the controls, at the same time turning the landing light on and off.

Assuming that the pilot had regained control, the copilot eased his grip on the controls. At a point 400 yards short of the "T," and approximately 150-200 feet from the ground, the aircraft entered a patch of dense fog. On breaking out, both the pilot and copilot saw a pine tree immediately in front which was higher than the tip path plane of the main rotor blades. Both pilots abruptly flared the aircraft and applied pitch to avoid striking the tree. In the process, the tail boom struck a tree and the helicopter nosed over to the right. The blades then struck the trees and the aircraft hit the ground on its right side. All occupants escaped uninjured and a small engine and ground fire were quickly extinguished.

There was a basic lack of understanding between the pilots both before and during the flight. Apparently, since this was only the second or third time they had flown together, the pilot had not yet given the copilot an adequate briefing. In their statements, each pilot indicated that he thought the other had control. When the pilot said, "I see it now," he probably depressed the mike switch on the cyclic stick and his left hand was on the collective as he turned on the searchlight. After hearing the pilot's statement and seeing his hands on the controls, the copilot apparently assumed that the pilot had control, so he eased his grip on the controls. From this point on until the aircraft flared and hit the trees, there was considerable doubt as to who had control, or if either pilot had control.

Neither pilot reacted properly to existing weather and terrain conditions. Actual elevation of the helipad from sea level was 470 feet. The crash site was 20 feet higher and the trees were approximately 40 feet tall. This would make the treetops 530 feet from sea level. According to their statements, the aircraft went into the fog bank at about 650-700 feet indicated, on what appeared to be a normal approach descent.

To contact the trees, the aircraft had to descend through at least 100 feet of scattered fog. At a normal rate of descent of 500 fpm, it would have been in the fog for 12 seconds. Either the pilots only lost sight of the "T" briefly and were descending at a rate considerably greater than 500 fpm, or they were in the fog longer than they realized. In one case, they would have failed to monitor their rate of descent, and in the other, they remained in a dangerous weather condition longer than they should have. With either possibility, they did not have control of the situation, as they landed 400 yards short of the "T" below the treeline.

Aircraft struck trees and crashed on its right side

Engine was torn free and cockpit demolished

U-1A Bounce-Stall-Torque

After several landings on the main runway, the IP and transitioning pilot began to practice short landings on the crosswind runway. They completed several landings. The IP noticed that the pilot was applying power too rapidly, causing the engine to backfire. He took control, broke away from the traffic pattern, and demonstrated the proper application of power several times.

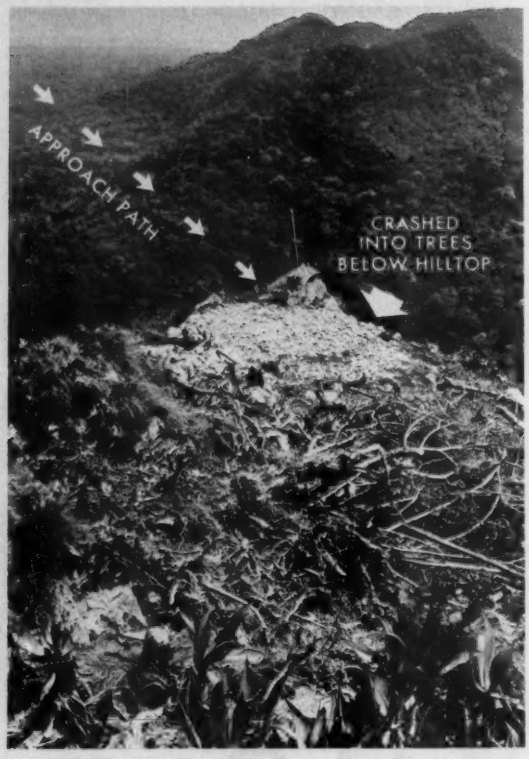
Telling the pilot this would be their last landing, the IP asked for and received a straight-in approach to the crosswind runway from a nondirectional beacon approximately 3 miles east of the airfield. The pilot made his final approach at approximately 60 knots with full flaps. The tower reported a quartering headwind from the left at 3 knots. When the main gear hit the runway, the aircraft bounced back into the air 4-6 feet. It stalled and the stall was further aggravated by an aft movement of the control yoke. The pilot jammed the throttle forward too fast. When the engine caught, torque caused the aircraft to yaw to the left and the left wing dropped about 40°.

The IP applied full power, attempting to go around, but he was too late. With the aircraft stalled in a medium bank to the left and the nose in takeoff attitude, directional control was lost. Full power torque forced the left wing further down and the situation became hopeless. After repeated left wing ground strikes, the flight path took the aircraft over the crest of a hill and it continued to roll, striking the ground on the left nose section in a 60° nose-down attitude, inverted. The force of impact caused complete and instantaneous shearing of the engine from its mounts. The left wing separated from the fuselage and sailed forward, coming to rest forward of the nose section.

The IP escaped with numerous facial cuts and bruises, but the pilot was trapped in the wreckage until the aircraft could be jacked up to free him. He sustained fractures, concussion, lacerations, and contusions.

crash sense

OH-23F MOUNTAIN PAD APPROACH



Intended landing point. Arrows show approach path and trees through which helicopter crashed.

The pilot: "... I took off with two passengers on board, about 100 pounds of equipment, and a light fuel load. I was to drop the passengers off at a prepared point. The flight to the point took about 20 minutes and the winds were about 5 knots from east to southeast.

"Since I had made an aerial recon of the point that morning and was familiar with the area, I elected to make a straight-in approach . . . I began a descent until I had the correct sighting on the Point, then began my approach. All was normal until about 5 feet out from the pad I felt a slight shudder. I thought momentarily that it was the wind, but then the aircraft made an uncontrollable turn to the right around the point. I found myself 180° from my original flight path, now facing the hill, with full left pedal, full left cyclic, and good power. The aircraft would not respond to the control pressures and continued to turn slowly to the right. I assumed I had tail rotor failure and reduced my power only about half, since a complete reduction would have placed the aircraft in full autorotation, and the area I had chosen to try for could not be reached in full autorotation.

"The aircraft began to turn to the left, but I was too late. Part of it, I'm not sure which, struck one of the trees. I told the passengers that we were in trouble, leveled the skids as best I could, and the thrashing of the main blades began. We fell through some very high trees, hit on the side of a great rock, and were thrown to the left, coming to rest at about a 45° angle to the left . . . Sparks were starting to fly and the engine was still running. I tried without success to kick out the front bubble as an exit for my passengers. I gave this up, rushed to the right door and helped one passenger through the door. The other passenger exited through the bubble where I'd tried to kick through.

"We stopped about 30 yards or so from the aircraft. It was at this time I noticed a severe pain in my left side and difficulty breathing. The aircraft engine ran for another 45 seconds or so and then quit. There was no visible fire. I sent one of the

passengers back to the aircraft for the first aid kit. While there, he put out a smouldering fire with the extinguisher and returned with the first aid kit. The other passenger had received a deep gash in his leg and a lesser one on his left arm. He also complained of chest pains, but I saw no evidence of shock and proceeded to bandage his wounds.

"Noting our approximate location, I thought it best that we make our way to a clearing at the base of the hill if the injured passenger felt up to it. He said he would try and we made our way slowly down the hill, crossed a small river, and arrived at the clearing to await pickup."

This pilot asked for trouble when he failed to make a reconnaissance of the pad to determine wind direction, velocity, and turbulence. The pad had not previously been used. His corrective action for suspected tail rotor failure (reducing pitch and power) at a critical point caused an excessive rate of descent and resulted in the aircraft striking trees.

Aircraft came to rest against tree. Note right wingtip in tree above nose section.

U-10 BUNDLE DROP

The copilot: "Operations had arranged for some tactical training to drop parachute bundles . . . About 2020 hours, the pilot and I climbed in and taxied down to the runup area . . . The aircraft checked out . . . and we got clearance to take off. We took off on runway 27, made a left turn, and climbed to 500 feet. I called the tower and told them we were going to pass east of the field at about 1 mile and 500 feet indicated . . . As we approached the drop zone, the pilot said he had the lights in sight. I took off my head set, unfastened myself from the seat belt, and turned around and knelt on the seat facing toward the rear of the air-

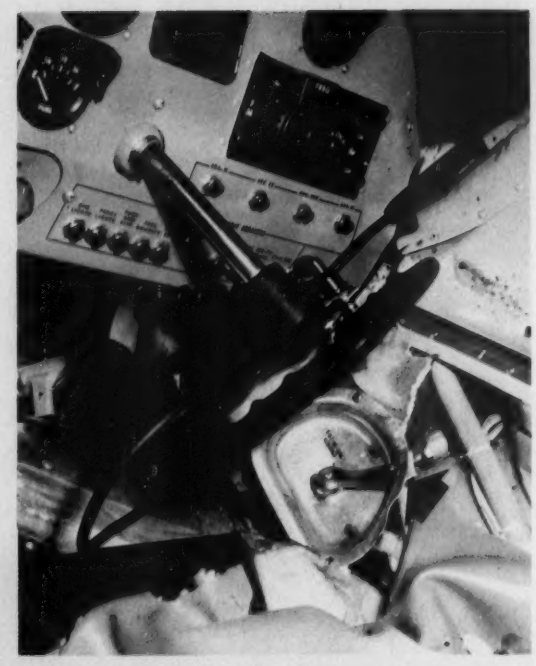
craft. We had been instructed to release the bundles at 200 feet above ground, flying at a speed of about 60 knots. On the first run, the pilot had slowed the aircraft to 60 knots and was flying at 500 feet indicated, since the ground elevation was 300 feet. As we approached the drop point, he tapped me with his hand and I pushed out the first bundle.

"I began to move the second bundle closer to the door. Just as I had it in the right position to push the bundle out for the second pass, I heard the engine begin to surge and at the same time the pilot yelled to me, 'We're in trouble.' I turned around, sat down in my seat, refastened my seat belt, and took a quick glance at the engine instruments. The only thing I remember for sure was that our manifold pressure reading was about 16" and the engine would surge, seem to stop, and surge again.

"I yelled to the pilot to put on the auxiliary fuel pump, which he did, and I reached over and pulled the carburetor heat on. This did not help. The pilot reached up and turned on the landing light. As soon as it flared, we looked out and could see about four pine trees right in front of us. When I saw the pine trees, I reached down and retightened my seat belt a split second before impact. We seemed to hit one tree before we came to rest on the ground against another tree. I remained conscious throughout. As soon as we were on the ground, everything was off—lights, radios, and the engine. There were no sounds except that of a gyro unwinding. I reached over and shut off all the switches and magnetos . . . I turned to the pilot and asked him how he was. He said, 'I'm hurt bad.' I checked to see what injuries I had and the only thing I found at that time was that my right foot was pinned beneath the VHF radio controls.

"The pilot unfastened his seat belt and began to pull himself out of the seat, using his hands. He pulled himself over his seat and partially out the right rear door, and he couldn't get any further, so he asked me to help him out. I reached out over his seat and pushed his feet on out the door and he landed on the ground somewhere under the right wing. That was as far as he got.

"I reached down and tried to feel what was pinning my foot and I tried to pry it loose with my hands, using my left foot for leverage. I tried to work it loose for about half an hour, but it wouldn't come free. I worked my head and shoulders through the window on the copilot's side where the plexiglass had been broken in the crash. Periodically, I yelled for help since I knew we weren't too far from the landing strip, but apparently no one could hear me. I asked the pilot if he could walk, move, or crawl to get some help and he said no, he was hurt too bad.



Fuel selector in two-thirds off position

"I could smell gasoline fumes and every time I pushed my head and shoulders out the window to yell, I would feel gasoline dripping on me. We lay there and waited for about 2-3 hours until a helicopter came over us with his light on and spotted us. He landed nearby and as the rescue party approached the aircraft, I yelled to them not to smoke or light any matches because the area was covered with gas. They took care of the pilot, then came back and dragged me from the aircraft. They put us in the helicopter and flew us to the hospital."

This accident was caused by the copilot inadvertently kicking the fuel selector to the two-thirds off position while he was pushing bundles out of the aircraft from the rear seat. As a result of this accident, an EIR on the design of the fuel selector and its location was submitted. Metal guards have been installed to prevent inadvertent closure of the fuel selector valve.

OV-1 EJECTION

The pilot: "Our mission was to photograph bridge sites along the river. We completed the mission approximately 1205 hours and proceeded back to the airfield to refuel and reload the camera for another mission.

"I called the tower for landing instructions and was cleared to left base for runway 27, to report 2 miles left base with gear. While the tower operator was giving these instructions, I throttled back to approximately 30 pounds of torque pressure, placed the aircraft in a descending pitch attitude, and turned right about 30° to set up my position for a left base. After passing 2,000 feet indicated, I brought the nose up to a cruise pitch attitude to decrease the rate of descent and airspeed. Before reaching 1,600 feet, I heard a click, followed immediately by the continually decreased pitch of the hum in my ears caused by the running aircraft

OV-1 loss caused by water in fuel

which I interpreted to be inverter stoppage. However, there was no indication on the enunciator panel.

"I slipped my hand against the circuit breaker panel and looked to see if any circuit breakers were out, at the same time turning the aircraft toward the airfield. At this point, I looked at my engine instruments and saw both torque pressures fall to zero. I also noticed that the warning flags on the FC 105 were out. I called the tower, reported electrical failure, placed the inverter switch to emergency, saw that both N_1 readings were about 60 percent, added power and watched both N_1 readings jump to 80 percent, then fall to zero.

"At this point, I declared an emergency, turned away from the airfield toward a wooded area in the populated area. I signaled the observer to eject and began putting switches on the left eyebrow panel in the emergency position. When I was sure the aircraft would fall into the wooded area, I pulled back the power levers and ejected.

"After regaining consciousness, I looked down and saw the aircraft crash in the woods. I landed in a tree about 50 yards from the wreckage."

Both engines were sent to a laboratory for teardown analysis to determine the cause of simultaneous failure. Here are the conclusions of this analysis: "Engine failure and loss of electrical power were caused by flameouts induced by the excessive amounts of contamination (water) noted in the fuel samples that were drawn from the fuel controls during engine disassembly. The chlorine traces found in the samples indicate that the water had been treated for drinking purposes."

The laboratory recommended that petroleum servicing personnel should be shown the Air Force training film, TF 1-5345, "Fuel Contamination—Jet Age Killer." This film covers the steps to be taken and procedures to be followed at base level in the control and handling of aircraft fuel.

U-6A SUCKER HOLE

The pilot: "I experienced a wedging effect from the ceiling tops, requiring me to climb to 9,500 feet to remain VFR on top. After reaching 9,500 feet, I still had to climb and I elected to tune in a command post nondirectional beacon and request an IFR control clearance direct to the command post. I was unable to read approach control and my instructions were relayed by a U-8 aircraft to descend to 6,000 feet, cleared direct to the command post. After starting the descent and going IFR, the U-8 aircraft relayed instructions from approach control to climb back to 9,500 feet and remain VFR on top. I immediately started to climb.

"Passing through 9,500, still IFR, with no definite VFR indications, I requested clearance back to the command post. I was now able to receive approach control, but unable to transmit clearly to them. Approach control cleared me to 7,000 feet, direct to the command post. After proceeding at 7,000 feet for approximately 40 minutes, approach control again contacted me for an estimate of my arrival and assured me of above ADF minimums. Our contact was now loud and clear both ways. The weather was given as 3,000 feet broken, visibility 3 miles in haze and light snow, with improving conditions.

"After proceeding for approximately seven more minutes, I encountered VFR conditions with a large hole for a possible VFR letdown. I recognized the surrounding terrain as an area approximately 25 miles east of my destination. I cancelled IFR and informed approach control of my approximate position. They acknowledged and informed me to contact the tower.

"After descending VFR to 1,800 feet, I proceeded west along the river. At this time I encountered almost zero visibility and a rapidly decreasing ceiling in a moderate snow and sleet shower. I immediately turned 180°. I proceeded east along the river and again encountered a zero visibility condition, which by this time had completely engulfed the valley.

"I chose an emergency landing area and circled it once, preparing for an emergency landing. I

Sucker hole led to cancelled IFR clearance, weather trap, and crash landing

made my approach and touched down three points. After 75 feet of roll, the left gear struck a hidden ditch and the gear collapsed. The aircraft came to rest 30° off my original landing direction."

Here's what the Army headquarters had to say in their letter of transmittal for the accident report: ". . . a check by this headquarters reveals that the pilot flew into these conditions knowing that he was not properly equipped, i.e., with no deicing equipment and no copilot. No attempt was made to contact the tower as he flew over an en route airfield. At that time, the en route airfield had a 4,000 foot broken cloud deck and 4 miles visibility. Apparently the aviator did not consider changing his decision to avoid instrument weather at any time during the entire flight, until he was caught in the valley and had to make a crash landing. It is therefore added that inadequate consideration of the weather by continued flight into instrument conditions was the major cause factor in this case.

"Inadequate regard for the weather by aviators is recognized as a major detriment to this command's safe flying record. A continuing program of command emphasis toward eliminating this factor is being carried out through the safety program, aviator training, and command action. . . ."

Long landing—no brakes

CV-2B DOWNWIND

The aircraft commander flew across the northeast end of the strip, making a high recon, and entered a left downwind. He noted the windsock indicated that the wind was out of the northeast, estimated at 8-10 knots. After turning final, the aircraft flew through a light rainshower reducing the visibility momentarily. On short final, the pilot noticed the wind had shifted to a quartering right tail wind. He decided to touch down at a point he estimated to be 300 feet beyond the approach end of the strip.

crash sense

Because of the downwind, the aircraft actually touched down approximately 600 feet beyond the end of the strip. The propellers were immediately placed in reverse idle but only the left propeller responded, indicated by the blue reversing indicator light on the instrument panel. The aircraft commander decided to go around and applied full throttles for takeoff. As they reached the end of the strip, he placed the gear handle in the up position and the copilot repositioned the flaps to 25°. Airspeed was approximately 45-50 knots at the time the aircraft left the end of the strip. It continued through the air across a gulley approximately 200 feet wide, toward a hill mass.

The aircraft commander pulled the control yoke to the rear to avoid hitting the hill with the nose section of the fuselage. The aircraft struck the hill mass, skidded 300 feet, with the landing gear collapsed to a trail position, continued up the slope over the top of a hill and came to rest perpendicular to the runway heading. The crew and 24 passengers escaped with no injuries.

In its analysis, the accident investigation board found these factors:

The aircraft commander depended completely upon the stopping capability of the reverse pitch propellers. The wheel brakes were not used and the aircraft commander had not selected a go-around point.

CH-21C Broom Dipstick

The aircraft and crew were TDY in support of an artillery brigade. When they arrived at the assigned location, the crewchief discovered his fuel dipstick was missing. Using the –20, he made a dipstick from a broom.

The following morning, the pilot prepared the flight plan and the copilot made the preflight. They took off at 0830 en route to an Air Force base, landed to pick up passengers, then continued to an assigned helipad. There the aircraft was shut down for approximately 15 minutes while equipment was loaded aboard.

Continuing to another helipad, they picked up two additional passengers and some more equipment, then returned to the original pad. There the aircraft was determined to have approximately 75 gallons of fuel remaining and the pilot requested an additional 125 gallons. The decision to carry only 200 gallons was made because of planned flights into small helipads where maximum power might be required.

The aircraft departed at noon, flew to another helipad, loaded equipment, and the crew took a lunch break. About one hour later, they departed for two other sites. At the second site, they were told that their cargo was to be off-loaded at a lower pad near the coast. The pilot told the crewchief to stick the tank for a fuel check. Using the broom

. . . led to Shawnee mud bath

dipstick, the crewchief could get no indication on the stick and told the pilot that he could not accurately gauge the fuel, but that they had less than 100 gallons remaining.

They took off and flew to the lower pad where the aircraft was again shut down to off-load. After the cargo was removed, the aircraft took off in a southerly direction, en route to another site to refuel. At approximately 200 feet, the engine failed and the aircraft was autorotated into the mud flats along the coast. It came to rest with the nose wheel sheared, the bottom portion of the front windows out, mud in the cockpit, and both sets of blades sheared and broken. The pilot, crewchief, and one passenger sustained minor injuries.

Tracing the afternoon flight path on a map, the investigation board found the distance flown to be 145 miles. Based on an average 80 knot airspeed, and allowing for traffic patterns, the board estimated this to be a two hour flight. The aircraft's records were checked for the preceding 10 days and it was found that the average fuel consumption was 98 gallons an hour for that period. Based on this evidence and the lack of any indication of engine malfunction, the board found the primary cause factor for this accident to be fuel exhaustion. They also found that extremely poor judgment, neglect, and complacency were demonstrated by all crew members during the flight. They further found that a poor autorotation technique was used because the pilot leveled the helicopter prior to touchdown with excessive forward speed.

CH-34C WHERE'S THE GROUND?

A right base for a landing into a 4-knot wind from the west was made to a snow covered sod area. Another CH-34 took off to the west from the intended landing area and the pilot of the landing CH-34 slowed his approach speed slightly to allow greater separation. Near the end of the approach, the aircraft ballooned, then began to sink. As it ballooned, the pilot lowered collective to compensate and then applied additional collective to reduce the resultant sink rate. The tail wheel struck the ground with enough force to shear the upper pylon attachment points, causing an immediate and complete disengagement of the tail rotor drive shaft splines at the tail pylon assembly. The aircraft had little if any forward speed.

After the tail hit, the helicopter momentarily assumed a level flight attitude, yawed, rolled toward the right. The right main landing gear hit while it was moving forward to the right and the support strut sheared, causing displacement of the transmission, forward and to the right. The aircraft then lurched forward and came to a stop upright, tilted approximately 20° to the right.

The pilot and copilot escaped through the cockpit windows, while the crewchief and passenger left through the emergency cabin window on the left front side of the cabin. Hydraulic fluid, leaking from a ruptured line on the transmission deck, ignited and the crewchief went back for the fire extinguisher to put it out.

The investigation board determined the cause to be loss of depth perception due to the approach without adequate ground references to a large snow covered area. This led to the tail wheel striking the ground prematurely and the resultant accident.

Snow caused loss of depth perception

CH-47 WIRE STRIKE

Tail-first impact after wire strike severed tail pylon

The mission called for two CH-47s to move supplies, equipment, and troops in support of a field maneuver. The crew was alerted at approximately midnight and hurried to operations for their briefing. The expected takeoff time was established as 0015 hours. They were given the pickup area, landing area, and radio frequency. The crews were concerned with weather, particularly the temperature and dewpoint spread. Fog in the area had been reported by other aviators, and marginal weather conditions had been predominant due to thunderstorms and rainshowers.

Here's the pilot's account: "The mission was to be flown as soon as possible, which was the way most of the missions were requested on the field problem. The operations officer indicated an APU start time of 0015 on the mission sheet. I did not consider this adequate time to allow for flight planning and delayed the starting time until 0045. I spent about 10 minutes planning the flight and briefing the other crew. I would have felt more confident with more time for flight planning, since the flight was a night sling load over unfamiliar territory to a field position with questionable weather. However, due to the urgency of the mission, no more time was taken.

"We departed at approximately 0055 hours and proceeded to fly the mission as requested. We landed and departed an intermediate location with three 500 gallon bags of fuel as an external load on each aircraft. At this time we had about 2,700 pounds of fuel remaining and I estimated this to be enough to deliver the load to the assigned area and return.

"I contacted our destination on 35.5 and was told to contact control on 30.0. I was then told to stand by on that frequency for contact by control. About 10 minutes from our landing zone, I established contact with control and was asked if we desired any assistance. I requested a directional steer as soon as we were in sight and landing information. Landing direction was given as 085° and elevation 650 feet.

"By this time, a very light hazy fog was forming in some areas. Control called that he had us in sight and gave two 10-20° steers to the left, then told us to continue straight ahead. He said he had lost sight of us behind the trees. We turned toward the left and did not receive immediate reidentification. The controller may not have had us in sight at all since there were two or three other aircraft in the area and he did not positively identify us with a turn or landing light. About this time another CH-47 called for landing information, so I contacted its pilot to see if he had us in sight. He didn't. Control called again that he thought he had us in sight and I flashed the landing light for positive identification, but I did not receive it.

"About this time, the pilot of our other aircraft said he had about 1,200 pounds of fuel remaining. I replied that if we did not locate the area this time, we would return to another airstrip and wait for fuel. Control called and said he was flashing a light on the ground and asked if we saw it. The pilots of our other aircraft thought they had the light in sight and turned toward the landing area. We could not see it and I asked if they had us in sight. They reported they saw us to their right at a higher altitude. What they apparently saw was another CH-47.

"We then saw a flashing light in the distance and started toward it, although we did not see the other aircraft. It turned out to be a flashing road marker when we were close enough to identify it through the light fog and haze. While we were near the ground, my IP elected to land in an open area he had spotted while I was answering a call about delivering the rest of the fuel. We were nearing the ground and the IP asked for the landing light. I turned his on.

"Shortly after that, he was yelling for me to arm the cargo switch and the aircraft was shuddering along with brilliant flashes of light. I armed the

switch and pressed the release button on the cyclic stick. I did not see any wires.

"By this time, the aircraft was pitching violently and going up. I got on the controls with the IP and we both lowered thrust to get the aircraft on the ground. When we were near the ground, I grasped for the engine conditioning levers, missing them the first time, and then reached again and got them both to stop. After the aircraft was stopped on the ground, I departed the cabin door with the crew-chief and flight engineer."

What the CH-47 struck proved to be a 3/8 inch ground wire on a powerline. The ground wire snapped and the aircraft continued along its flight path until it struck the ground on all four gears. It then bounced into the air and hit going backwards, with the tail of the aircraft drifting slightly left in an extreme nose-high attitude. This second contact was severe enough to buckle the aft pylon and tear it loose on the right side. This caused dephasing of the rotor blades and they struck each other and the ground. A fire started in the pylon area from the generators, but was quickly extinguished.

The accident investigation board determined the primary cause of this accident to be a wire strike. Contributing factors were listed as:

- A sence of urgency affected the pilot's planning. Although he had taken additional time to plan the mission, adequate planning was not accomplished. This was due to the tactical situation requiring immediate response at all levels of command.
- Inadequate unit training in night operations with pathfinders, due to nonavailability of aircraft for this purpose.
- Aviator fatigue due to personnel failing to take advantage of available time for crew rest. The IP had slept only 3 hours during the past 48 hours, and the pilot had slept only 3 hours during the past 36 hours, although adequate opportunity was afforded both men for rest.

INTENSITIES OF ICING

Lt Col Frank W. Breitling, Jr., Operations Officer, 16th Weather Squadron, 2d Weather Group (MATS), United States Air Force, has furnished the following definitions of intensities of icing which are in current use by the Air Weather Service throughout the world.

Explanations. The National Coordinating Committee for Aviation Meteorology (NACCAM) at its meeting on 25 February 1964 established standard designations of icing intensities. These intensity definitions are based upon meteorological criteria and operational criteria. The operational explanations, given below, are based upon the rate at which ice accumulates on a small probe.

Trace of Icing. Accumulation of 1/2 inch of ice on a small probe per 80 miles. The presence of ice on the airframe is perceptible but the rate of accretion is nearly balanced by the rate of sublimation. Therefore, this is not a hazard unless encountered for an extended period of time. The use of deicing equipment is unnecessary.

Light Icing. Accumulation of 1/2 inch of ice on a small probe per 40 miles. The rate of accretion is sufficient to create a hazard if flight is prolonged in these conditions but is insufficient to make diversionary action necessary. Occasional use of deicing equipment may be necessary.

Moderate Icing. Accumulation of 1/2 inch of ice on a small probe per 20 miles. On the airframe, the rate of accretion is excessive, making even short encounters under these conditions hazardous. Immediate diversion is necessary or use of deicing equipment is mandatory.

Heavy Icing. Accumulation of 1/2 inch of ice on a small probe per 10 miles or less. Under these conditions, deicing equipment fails to reduce or control the hazard.

Intensity Forecasts. AWS policy is that forecasts of icing intensity should represent the probable maximum intensity expected to exist at the point in space and time for which the forecast is made and not necessarily the intensity which the aircraft will encounter. This is because the variations in flight paths actually flown, aircraft types, and pilot procedures and techniques are nonmeteorological factors which influence the intensity of icing actually encountered under a given set of meteorological conditions.

Equivalent Terms

WMO/ICAO, (International)	*USWB USN*	*(Domestic), AWS, NACAAM*
No equivalent term	No equivalent term	Trace
Light	Light	Light
Moderate	Moderate	Moderate
Severe	Heavy	Heavy

Our objective is to eventually produce icing forecasts in terms of liquid water content. This procedure will require the development of charts or tables to provide effects on particular aircraft, since icing does vary with both aircraft configuration and speed. In the interim we will continue to use the icing terms shown below. Since objective values of the term used by other agencies are not available, we assume our terms mean about the same as theirs.

Mechanic's Creed

ON MY HONOR I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a qualified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I feel to be beyond the limits of my knowledge; nor shall I allow any nonqualified superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a professional maintenance technician to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.

—Air Force Flying Safety Officers' Kit

10 Little Pilot Boys

Ten little pilot boys, off to get their time,
One ignored his flight plan and then there were nine.

Nine little pilot boys, one of them was late,
Went and taxied out too fast and then there were eight.

Eight little pilot boys, all their engines revving,
One retracted landing gear and then there were seven.

Seven little pilot boys, one knew all the tricks,
Flew under low overcast and then there were six.

Six little pilot boys, eager to arrive,
One overthrottled and then there were five.

Five little pilot boys, flying close to shore,
One buzzed some motorboats and then there were four.

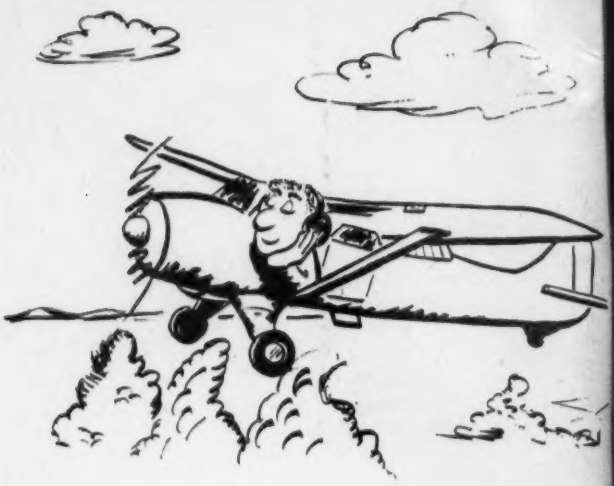
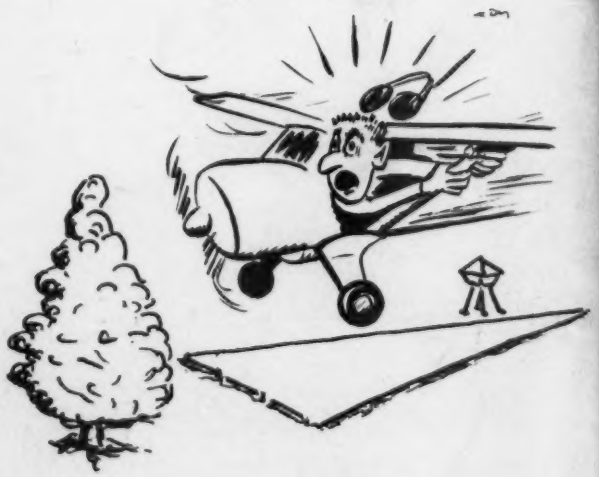
Four little pilot boys, one came down at sea,
Didn't know his dinghy drill, and then there were three.

Three little pilot boys, soaring thru the blue,
One exhausted all his fuel and then there were two.

Two little pilot boys, one wanted some foolish fun,
Flew thru a thunderhead and then there was one.

One little pilot boy, eager to be done,
Overshot, did not go round and then there was none.

No little pilot boys left to shoot a line
Of varied experiences while getting in their time.

And ten expensive aircraft will never fly again,
With their ten expensive aircrews who took so long to train.

Aircraft Accident Prevention, MacDill Field
Submitted by Capt Patrick J. Wilson, USAR